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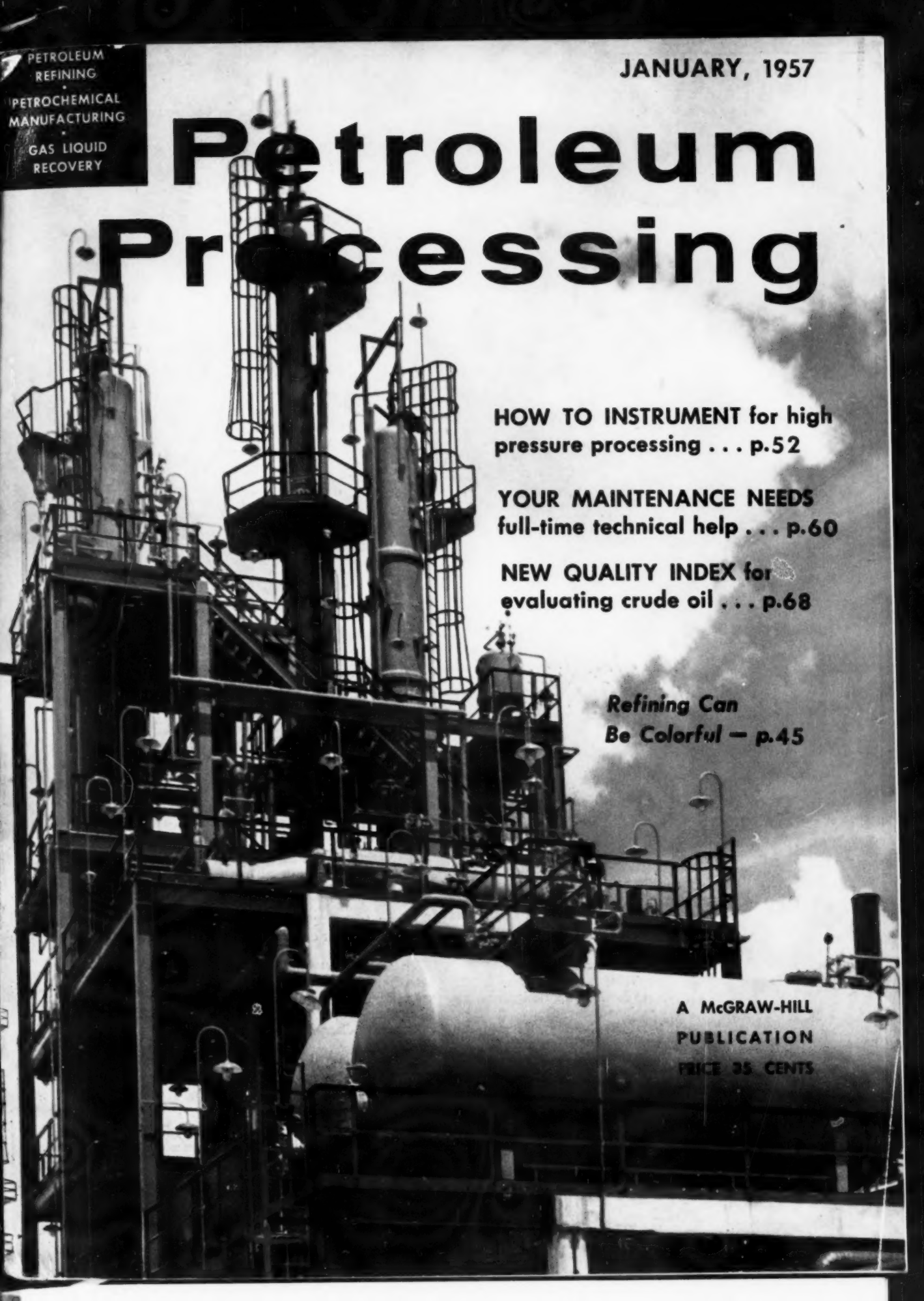
JANUARY, 1957

Petroleum Processing



HOW TO INSTRUMENT for high pressure processing . . . p.52

YOUR MAINTENANCE NEEDS full-time technical help . . . p.60

NEW QUALITY INDEX for evaluating crude oil . . . p.68

Refining Can Be Colorful — p.45

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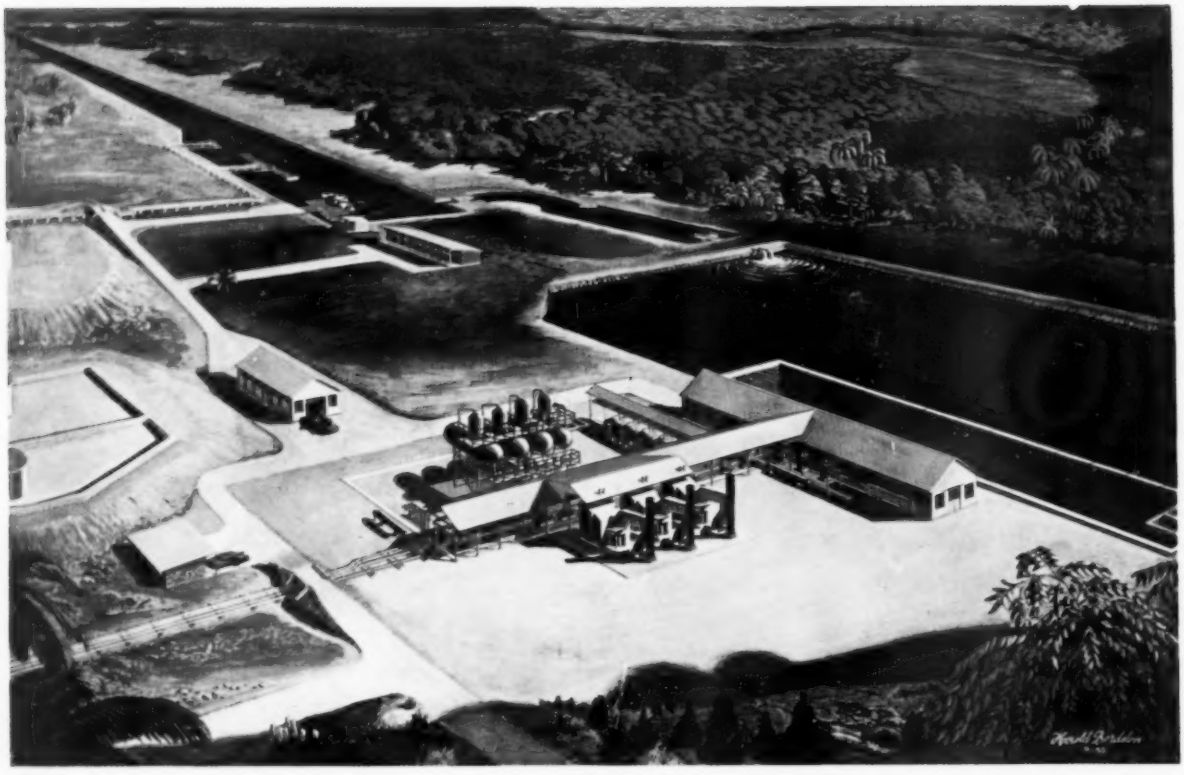

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Production capacity is 1500 long tons per day with present plant facilities which are designed for expansion to produce 3,300 tons per day.

The completion of these facilities on the Isthmus of Tehuantepec adds to the long list of clients entrusting to Hudson the design, procurement and construction of major mining, chemical and petroleum plant projects in the United States, Mexico, South America, Canada, Europe, the Orient, and the Near East.

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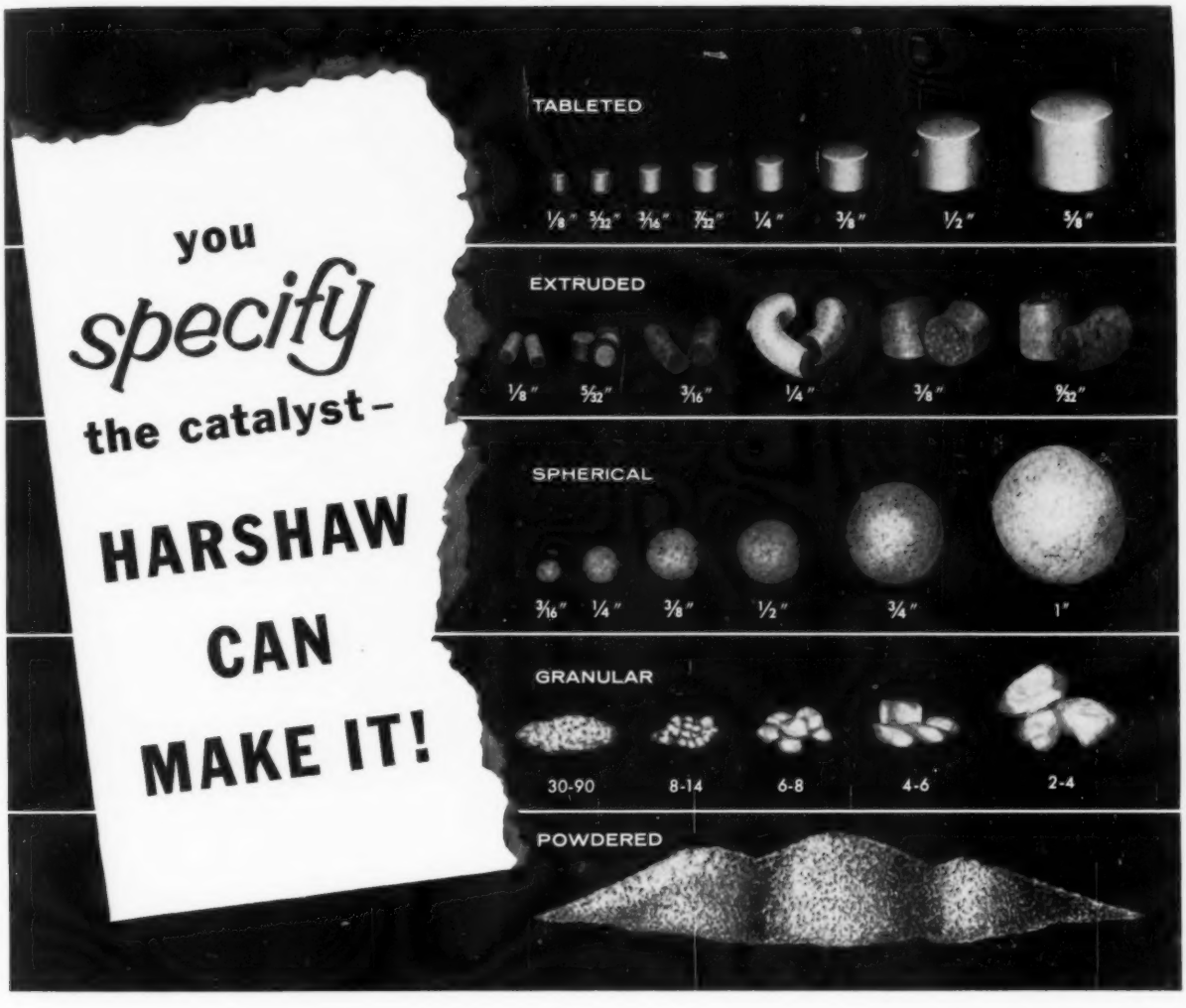

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(To obtain more data on advertised products see page 132)

Reader's Guide

What's New in Petroleum

PETROLEUM REFINING | PETROCHEMICAL MANUFACTURING | GAS LIQUIDS RECOVERY | RESEARCH & DEVELOPMENT | DESIGN & ENGINEERING | PLANT OPERATION | MAINTENANCE & CONSTRUCTION | MANAGEMENT & PERSONAL

Surge Ahead for Asphalt

The $50-million, 10-year highway construction program now under way has catalyzed demand for this product but posed some problems too. This three-part article by Associate Editor V. B. Guthrie and Assistant Editor W. A. Bussard will give you:

- **A general round-up of today's situation,** how the higher demand will be met, the problems of state inspections, possibility of fewer grades, and potential market for non-asphaltic product sales.
- **A look at continuous blending** as a better way to make larger volumes of higher quality asphalts.
- **A complete rundown of the 31 grades** of asphalt being made and their specifications. **p. 39**

I 2 3 5

The "Picks of '56"

Your response as readers to new products, supplies, and equipment, as reviewed in "What's New," represents a gage of the most important new ideas being developed for your field of activity. Here is your annual review of the best from last year. **p. 50**

I II III 1 2 3 4 5

High Pressure Instruments

How tomorrow's processes above 10,000 psi will be measured. A thorough-going discussion of the instruments here today to handle such operations —including temperature, pressure, flow, level. By William Adamson of M. W. Kellogg Co. **p. 52**

I II III 2 3 4

Refining Can Be Colorful

This month's four-color cover photograph shows what happened at Esso Standard Oil Co.'s Louisiana refinery when "Baton Rouge Got a Facelifting." What did happen was that morale, safety, and housekeeping all got a big lift too. **p. 45**

I II III 3 4 5

New Tray Design

Called a "ripple tray," it is a brand new approach to providing a tool for better vapor-liquid contact, has high capacity, has simple construction, gives tray efficiencies insensitive to wide load variations, and is self-cleaning. **p. 58**

I II III 1 2 3

Want Better Sweetening?

Here's a new and improved inhibitor sweetening process in which doctor injection was added. A complete report on results from full-scale commercial operation and laboratory work, by L. D. Rampino and M. J. Gorham of Tidewater Oil Co. **p. 46**

I III 3 5

Let's Study Maintenance

We spend millions on new processes, yet let maintenance hobble along hand-to-mouth, argues V. J. Loyd in "Give Your Maintenance Department Full Time Technical Help." **p. 60**

I II III 4

A McGRAW-HILL PUBLICATION

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Petroleum Processing is published monthly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948) founder.

Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. Publication Office: 871 N. Franklin St., Chicago 10, Ill. Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice-President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director, Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice-President and Circulation Coordinator.

Subscriptions: Address correspondence to Petroleum Processing, Subscription Service, 330 West 42nd St., New York 36, N. Y. Subscription rates: domestic single copies, 35¢, U. S. and possessions, Canada, and all other countries, $2 per year, $3 for two years, $4 for three years. Orders must indicate company and position.

Published prior to Sept. 1946 as the Technical Section of National Petroleum News, devoted to Refinery Management and Petroleum Chemical Technology, and including International Petroleum Technology.

Second class mail privileges authorized at Chicago, Ill. Printed in U.S.A. Copyright 1957 by McGraw-Hill Publishing Co., Inc. All rights reserved.

Processing for January, 1957

PETROLEUM REFINING | PETROCHEMICAL MANUFACTURING | GAS LIQUIDS RECOVERY | RESEARCH & DEVELOPMENT | DESIGN & ENGINEERING | PLANT OPERATION | MAINTENANCE & CONSTRUCTION | MANAGEMENT & PERSONAL

Five Career Essentials

How New Mexico's first catalytic reformer is operating today on 60% well condensate and 40% straight run gasoline. A story told within a flow-sheet, tracing one of the country's most unusual processing schemes. **p. 64**

I II III 1 2 3 4 5

Meet Harry W. Ferguson

He's the newly-elected vice president for refining of the American Petroleum Institute. Southwestern Editor Ron Cannon interviewed him at his Humble Oil & Refining Co. office (he's vice president of Humble) to bring you this close-up. **p. 75**

I 1 2 3 4 5

Mixed Feed Reforming

What does today's top management want from you as a technical man (besides technical ability) and why do they rate these qualities important? For the answers Stuart Boynton went to management and here's his report on what they said. **p. 66**

I III 3

Are You Getting All You Want?

Your Readers' Service card system has been designed to increase its efficiency for your convenience. Do you need extra copies of popular reprints? How about extra copies of Clip-n-File Data Sheets? Turn to . . . **p. 133**

I II III 1 2 3 4 5

New Crude Oil Quality Index

As proposed by David Rothbard, this new system could provide several improvements over existing methods for rating the quality of any given crude oil you have to process.

But here's a plus value. Like any technical meeting, we've provided a "prepared discussion" on author Rothbard's paper. And this is in turn followed by a prepared reply from Mr. Rothbard.

Take part yourself. Read the article, discussion and reply. Then write us your own comments. **p. 68**

I 1 3

Watch your Upcoming Issues

. . . for a continuing stream of new information and data to help you on your job. Don't miss out.

Articles scheduled for early publication include those on the following subjects:

- Design methods for low-finned heat exchanger tubing.
- Another special editorial report—this one is on a piece of every-day equipment whose importance is frequently underestimated.
- Start of the 1957 series of articles on the popular technical clinics of the Western Petroleum Refiners Association.
- Methods for determining fuel oil stability.

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Continue "Reader's Guide" on p. 79

HOW TO USE IT:

Your new "Readers' Guide to What's New in PETROLEUM PROCESSING" will do two things for you. First, the key numbers with each article will tell you at a glance if it is within your scope of interest: roman numerals indicate industries; arabic numerals show fields of activity. Secondly, the longer descriptions will tell you what each article is about, and why it can be of help and interest to you.—THE EDITORS

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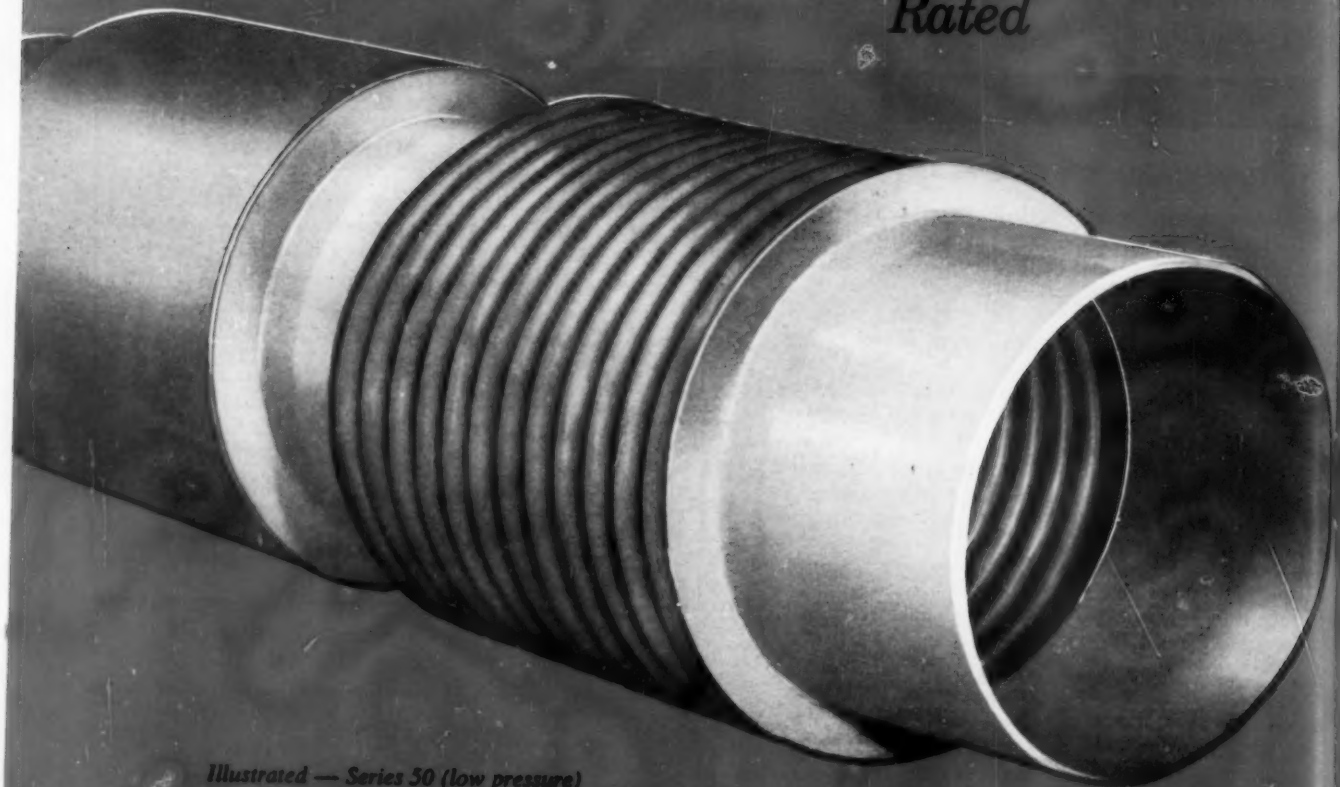


Illustrated — Series 50 (low pressure) S-R Double Joint with welding ends. Cover removed from one bellows.

's most experienced manufacturer

Revolutionary new design provides longer cyclic life... less weight... better equalization

Over three years of intensive research and testing have paid off! Badger S-R Expansion Joints — corrugated packless expansion joints of an entirely new design — are ready for your most exacting power, heating, industrial and process piping applications.

Two significant features of the new joints are 1.) Curvilinear Corrugations, which result in natural "all-curve" flexing and equal distribution of movement among the corrugations; 2.) tubular Reinforcing Rings, which work with the new corrugations to produce greater effective flexing height and "all-curve" flexing even under higher pressures and temperatures.

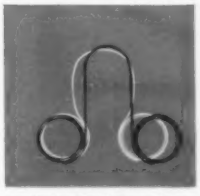
And there are other important features, too . . . size for size, Badger S-R Joints weigh up to 50% less than conventional types . . . new ring design reduces joint diameter . . . a complete line of accessories — including covers and liners — are available . . . standard models in stainless, monel and inconel, special types in any workable alloy.

Cutaway view Series 150 (intermediate pressure) S-R Joint

New corrugation and ring designs produce better equalization, "all-curve" flexing

Series 50 (low pressure) S-R Expansion Joints

The radically different Curvilinear Corrugations used in Badger S-R Expansion Joints were developed by the Badger Research Department. As shown in the cross-section of a Series 50 Joint (left), the design produces more uniform movement per corrugation and flexing to a natural "all-curve" shape, which results in lower stresses and therefore increased life. (White line in diagram shows the efficient "all-curve" shape the corrugations *naturally* assume under operating pressures.)


Series 150 (intermediate pressure) S-R Expansion Joints

Series 150 S-R Joints feature Curvilinear Corrugations and, because they are used at higher pressures, also have tubular Reinforcing Rings. A significant engineering improvement, these new rings make metal-to-metal contact only in the "valley" of each corrugation yet allow natural "all-curve" flexing (white line) when the pipeline is subjected to pressure. The tubular shape of the rings also permits greater effective flexing height and therefore contributes to longer joint life.

Learn more about ways S-R Joints can be of advantage to you . . .

New illustrated brochure describes them in detail — mail coupon for your free copy today.

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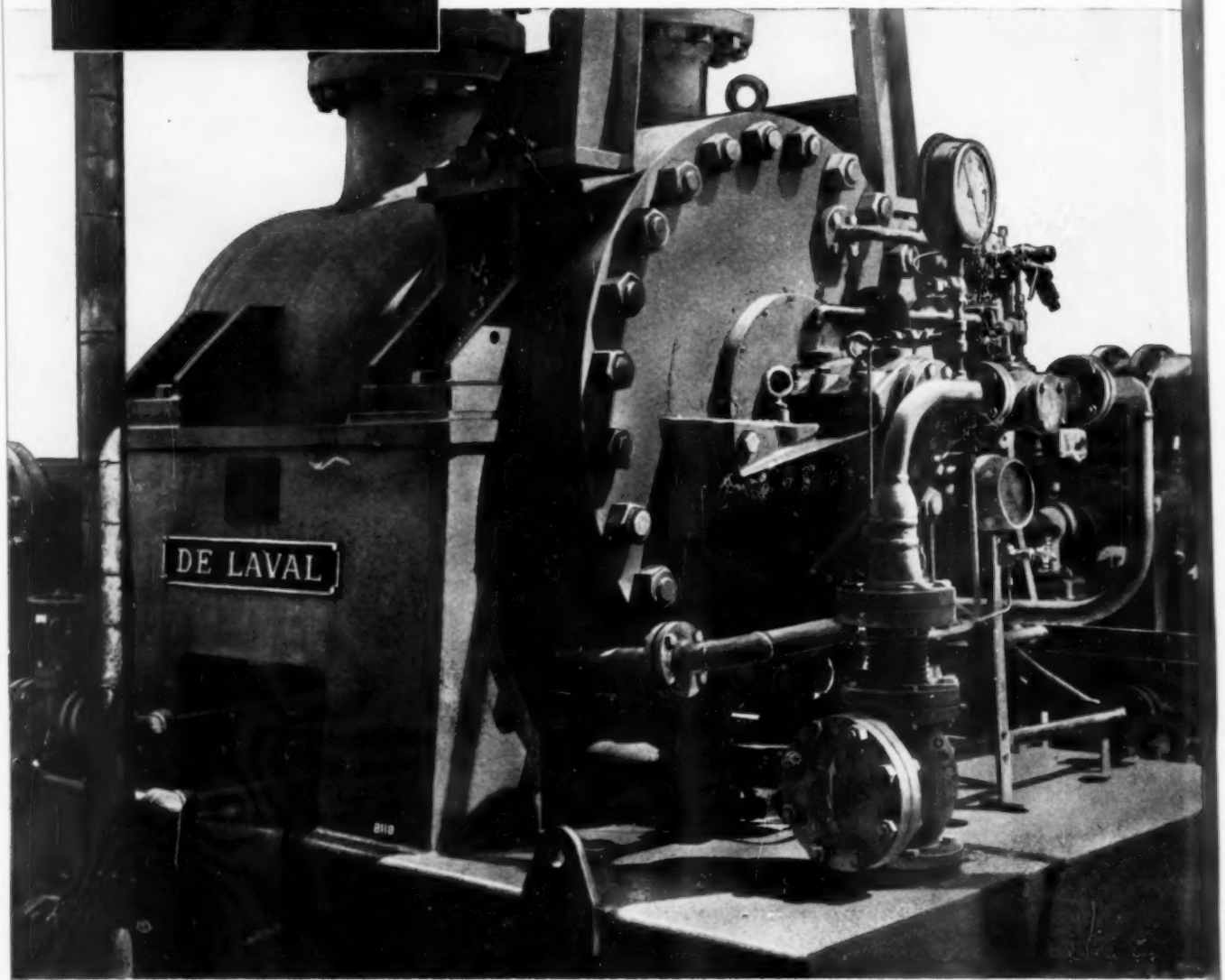

Send for new Bulletin 0504

This De Laval centrifugal recycle barrel type compressor is doing a dependable job handling hydrogen under high pressures at the General Petroleum plant in Ferndale, Washington. It takes hydrogen at an inlet pressure of 500 psig and discharges it at 625 psig. The unit is driven by a 1110 hp turbine operating at 9900 rpm.

General Petroleum Corporation is only one of many refiners who have specified De Laval Compressors. Whether you need to handle light or heavy gases at high or low pressures in catalytic cracking, reforming, alkylation, coking or any similar service, it pays to look to De Laval. Rugged De Laval centrifugal compressors perform dependably in heavy-duty continuous operation. De Laval has more than 40 years of experience in solving gas compression problems.

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Dear Reader...

. . . Something to Look Forward to—last month we ended the year with a big summary—our Annual Index. So let's start off the new year with a little preview of what's ahead—the 1957 editorial bonuses.

Next month, February, we start a 3-part series on the design of low-finned heat exchangers. With the new design methods explained in these articles, you'll be able to take advantage of the benefits of extended surface tubing in shell-and-tube exchangers—something that hasn't been too easy in the past.

In March you'll get the first of PETROLEUM PROCESSING's 1957 Special Reference Reports. This one will tell you all about gaskets—how they work (and why they don't, sometimes), how they're designed, which materials to use, and how to get better gaskets. Gaskets may sound like a simple little piece of mechanical equipment to devote a whole 16-page report to, but many a unit has had an emergency shutdown because of a gasket failure—the result of improper design or installation.

April brings our annual roundup on what API's Refining Division committees are up to—projects in the works and their status. We're running these reports a month earlier than usual this year, so that you'll have more time to study them in advance of the committee meetings (in Philadelphia in May).

Comes May—and our first annual Refining Industry Report. Details are still being planned, but it'll have a brand new refining directory, that promises to be so complete and useful you can toss out all the other plant listings you now have, a new engineering firm directory, and a new Glossary of Refining Processes.

And in June—our second 1957 Special Reference Report. This one will be on Low Temperature Insulation. It's one thing to insulate to keep heat in a unit, but an entirely different matter when you're operating below freezing and want to keep heat out. This report will explain the problems—and how to solve them.

That takes us to midyear—and there's just as much planned for the second six months.

Some of you might ask why we "spill the beans" and tell you all our plans—which makes it possible for our competitors to jump in and beat us to the punch.

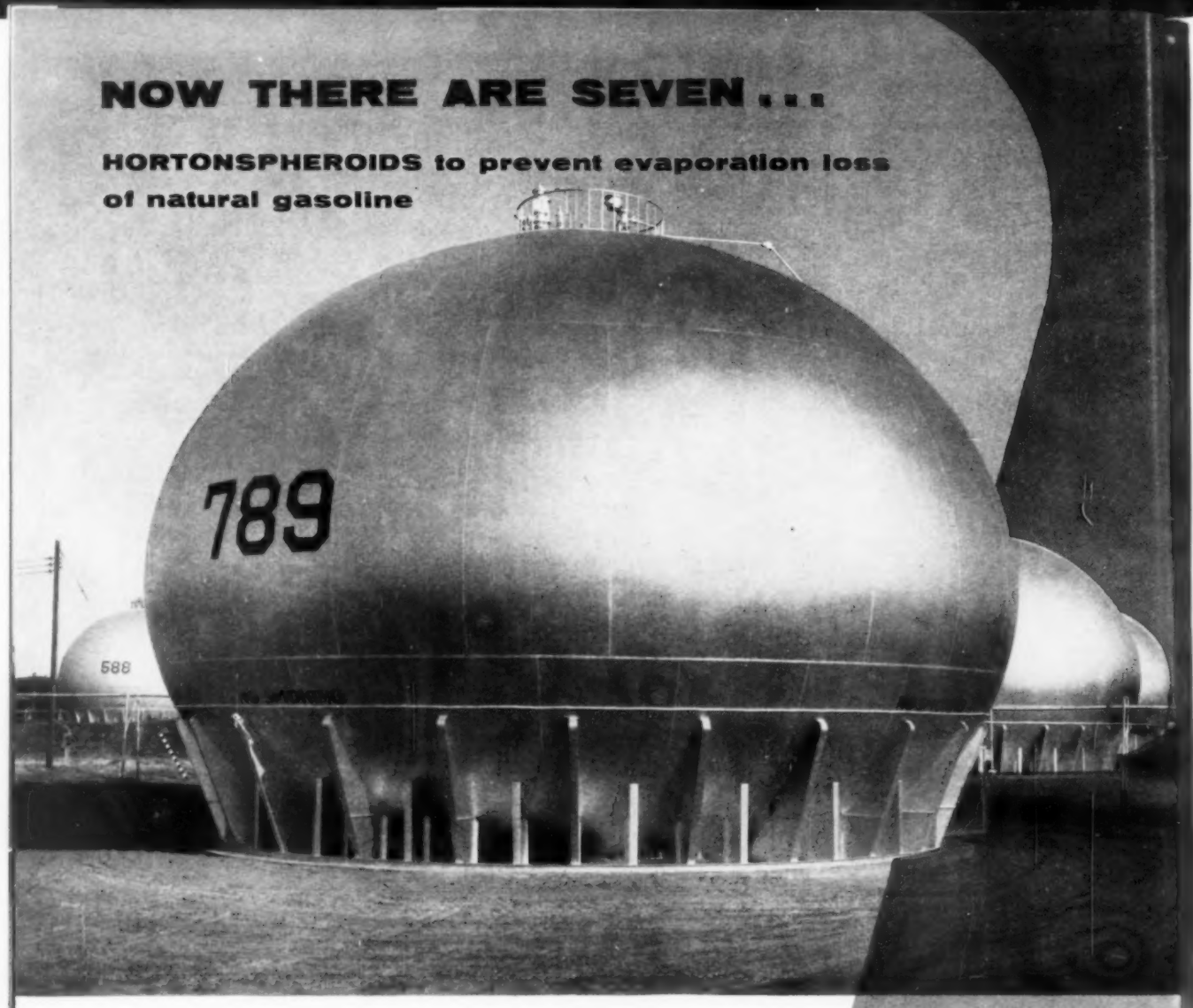
Frankly, I'm not much concerned about being "scooped." Our competitors may know *what* we're planning to do, but they don't know *how* we're going to do it. And I think enough of the editors on my staff to feel confident we can do a more thorough, competent, and useful job at least 9 times out of 10. And I'm willing to take my chances on that 10th time.

William F. Bland

—Editor

NOW THERE ARE SEVEN . . .

HORTONSPHEROIDS to prevent evaporation loss of natural gasoline



The addition of two 20,000-bbl. Hortonspheroids® brings the total to seven at the D-X Sunray Oil Company, Tulsa, Oklahoma. The two latest structures are designed for 20 lbs. per sq. in. working pressure. The steel plates were pickled and painted by the Horton Pickling Process before shipment from the plant.

No evaporation from volatile liquids stored in a Hortonspheroid can occur as long as the internal pressure does not exceed the settings of the pressure relief valves.

Hortonspheroids are built in sizes to 120,000 bbls. and for pressures up to 100 lbs. per sq. in. in the smaller capacities. Write our nearest office for further information or quotations.

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WHAT'S HAPPENING

in Refining

. . . **Surge ahead for asphalt:** The recently-approved $50-billion highway construction program is now getting under way, catalyzing the demand for this petroleum product and posing some new problems for the processing industry.

Total U.S. requirements for asphalt for all uses are expected to hit 135-137 million bbl/yr in the next few years. That's a daily rate of about 370,000 bbl, and is triple the sales of asphalt since World War II.

The road program will of course add also to demand for all motor fuel and lube products as well. Few problems are expected in meeting the demand for this increased volume of asphalt, but some changes will apparently have to take place in the present-day, burdensome, and confusing inspection situation.

For more details on the asphalt picture today, turn to p. 39, this issue. See also our editorial viewpoint, p. 166.

. . . **M. W. Kellogg Co.,** New York, N. Y., has announced its new non-platinum, noble metal catalyst, isomerization process, Iso-Kel. Further details on this process can be found on p. 135 of this issue.

. . . **Anderson-Prichard Oil Corp.** has awarded a contract to Badger Mfg. Co. to engineer and build a 3000 b/d propane deasphalting unit at its Arkansas City, Kans., refinery as part of a 5000 b/d expansion program.

. . . **California Research Corp.** has installed a 2-million volt Van de Graaff particle accelerator at the Richmond, Calif., laboratories. The machine will be used to study effects of radiation on petroleum and its products, and the acceleration of reactions.

. . . **Cities Service Oil Co. Ltd.** plans a 20,000 b/d refinery in the Toronto, Ont., area with an outlay of about $22-million in 1957. Contractor for refinery is C. F. Braun Co. of Canada, Ltd.

. . . **Clark Oil & Refining Corp.** soon will start installation of a 16,000 b/d UOP fluid catalytic cracking unit, a 16,000 b/d alkylation unit, and a gas recovery unit. Completion is due later this year.

. . . **Douglas Oil Co. of Calif.** will have Macco Corp. build a Unifining unit at the Bakersfield, Calif., refinery. Completion is due in mid-1957. This is the first step in a $1.25-million expansion program planned by Douglas.

. . . **Gulf Oil Corp.** has acquired options on 3000 acres near Charleston, S. C., and is making a study to determine whether the site would be suitable for refinery "at some future date."

. . . **Imperial Oil Ltd.** intends to add 8500 b/d capacity at its Calgary, Alta., refinery, and add 2500 b/d capacity at its Winnipeg, Man., refinery.

. . . **Phillips Petroleum Co.** is reportedly the first refinery to license Universal Oil Products Co.'s new Penex isomerization process, though the company will neither confirm nor deny the report.

. . . **Standard Oil Co. of Ohio**'s $40-million expansion program at its Toledo, Ohio, refinery (see PETROLEUM PROCESSING, Dec., 1956, p. 9) will be handled by M. W. Kellogg Co., with completion planned April 1958.

. . . **Tidewater Oil Co.** plans a 22,500 b/d Houdriformer at its Avon, Calif., refinery. Completion is scheduled for 1958, with Bechtel Corp. reported under contract for the construction.

. . . **U. S. Oil & Refining Co.**'s 8000 b/d refinery at Tacoma, Wash., is now scheduled to be onstream by May or June of this year.

. . . **Vickers Petroleum Co.**'s new $1-million, 3500 b/d Ultraformer is now under construction by Ralph M. Parsons Co., with completion scheduled for May 1957 at Vickers' Potwin, Kans., refinery.

. . . **Wilshire Oil Co.**'s plans for a Hawaiian refinery are temporarily dampened by the current tanker shortage.

. . . **Plans for capital expenditures** by the refining industry, as revealed in annual McGraw-Hill survey of business plans for capital spending, show a 50% boost in 1957 over expected total for 1956.

Refining companies are expected to spend $1.014-billion this year, as compared to $676-million in 1956. Anticipated rise for entire petroleum industry will not be quite as spectacular: going from $5.618-billion in 1956 to $6.059-billion this year.

. . . **Other new construction projects,** indicated by recent fast tax write-off approvals, are:

- Commerce Oil Refining Corp., $31,966,500 for a new refinery at Jamestown, R. I.
- Socony Mobil Oil Co., Inc., $2,470,000 for a Sovaformer at Trenton, Mich.
- Ashland Oil & Refining Co., $1,900,000 for refining facilities at Canton, Ohio.
- Frontier Oil Refining Co., Div. of Ashland Oil & Refining Co., $2,000,000 for catalytic reforming and hydrodesulfurization capacity at its Tonowanda, N. Y., refinery.

in Gas Liquids Recovery

. . . **Dorchester Corp.** is adding a combination Unifiner-Catformer, licensed by Atlantic Refining Co., at its natural gasoline plant near White Deer, Texas. Feedstock will be a depentanized natural gasoline;

design and construction will be by Grebe & Doremus Process Co.

. . . **A group of Texas natural gasoline producers** reportedly plans a joint processing facility with fractionation, isomerization, and possibly catalytic reforming. Purpose is to make high-octane gasoline in competitive volumes.

. . . **Phillips Petroleum Co. and Pacific Petroleums Ltd.** will build a $20-million refinery at Taylor Flats, B. C., to use natural gas liquids as the feedstock. Capacity has not been announced, but refinery units will include distillation, catalytic desulfurization and reforming, dehydrogenation, butane isomerization, alkylation, blending and storage. Natural gas liquids will come from a natural gasoline plant that Westcoast Transmission Co. is building at Taylor, B. C.

in Petrochemicals

. . . **Amoco Chemical Corp.,** newly formed chemical subsidiary of Standard Oil Co. of Indiana (see PETROLEUM PROCESSING, May, 1955, p. 10, has announced its first major project for 1957. The company will build a $10-million, 60-million lb/yr plant to use the xylene oxidation process (described on p. 16 of this issue) bought from Scientific Design Co., Inc., last year. Location for the new plant has not been announced, but could be in the Chicago area. Completion is scheduled for 1958.

. . . **Ammonia Chemical Corp. of Calif.** will build a $5-million anhydrous ammonia plant near Huron in Fresno County, Calif. The plant will process 5-million cu ft/day feedstock gas, and will go onstream late this year.

. . . **Blaw-Knox Co.** of Pittsburgh, Pa., has a licensing agreement with Societé Belge de l'Azote (SBA) of Liege, Belgium to offer the new SBA acetylene process to the petrochemical industry.

. . . **Dow Chemical Co.** will, for the first time, make ethanolamines as a result of its sizable ethylene derivative expansion in progress at Freeport, Texas.

. . . **Dow Chemical Co. of Canada** is planning a polyethylene unit at its Sarnia, Ont., works.

. . . **Ethyl Corp.** has found a new process for making tetraethyl lead involving a reaction between a metal alkyl and a lead compound. Though development work is still in the initial stages, the new process "shows considerable promise."

. . . **General Aniline & Film Corp.** has awarded SD Plants, Inc. (construction subsidiary of Scientific Design Co., Inc.) an $8-million contract to build a plant to make 60-million lb/yr of ethylene oxide and 35-million lb/yr of ethylene glycol.

. . . **Humble Oil & Refining Co.** plans a low-temperature gas recovery unit at its Baytown refinery. Completion is scheduled for early 1958.

. . . **Laurentide Chemical & Sulphur Co.** is building a $1.25-million, 33,000 long t/yr sulfur recovery plant at Montreal East, Que., to process sour gases from refiners in the area.

. . . **Lion Oil Co.** is building a nitric acid concentrator at its El Dorado, Ark., chemical plant. Chemical & Industrial Construction Corp. is building the plant, designed to produce 40 t/d of 95% nitric acid from 58% nitric acid feed.

. . . **Monsanto Chemical Co.** plans a 25% increase in its present 500,000 lb/yr phenol production capacity at its Monsanto, Ill., plant. Completion is scheduled for late 1958.

. . . **Petroleum Chemicals, Inc.** (Cities Service Co. and Continental Oil Co.) has started building a 200-million lb/yr plant at Lake Charles, La., to make standard and high-purity ethylene. The contractor is Lummus Co., and completion is scheduled for January, 1958.

. . . **Shell Chemical Co.** has completed two Epon resin units at its Houston, Texas, plant that will triple its production of these resins.

in Transition

. . . **Britalta Petroleums,** of Vancouver, B. C., stockholders have voted in favor of acquiring Wilshire Oil Co. of Midland, Teaxs.

. . . **Chicago Corp.** of Fort Worth, Texas, will merge with its wholly-owned subsidiary, Champlin Refining Co., and change its name to Champlin Oil & Refining Co. Champlain has a 31,000 b/d refinery at Enid, Okla.

. . . **El Dorado Refining Co.** of El Dorado, Kans., has been acquired by Petro-Atlas Corp. of Tulsa, Okla. Deal includes 18,000 b/d refinery at El Dorado, as well as crude production and other assets.

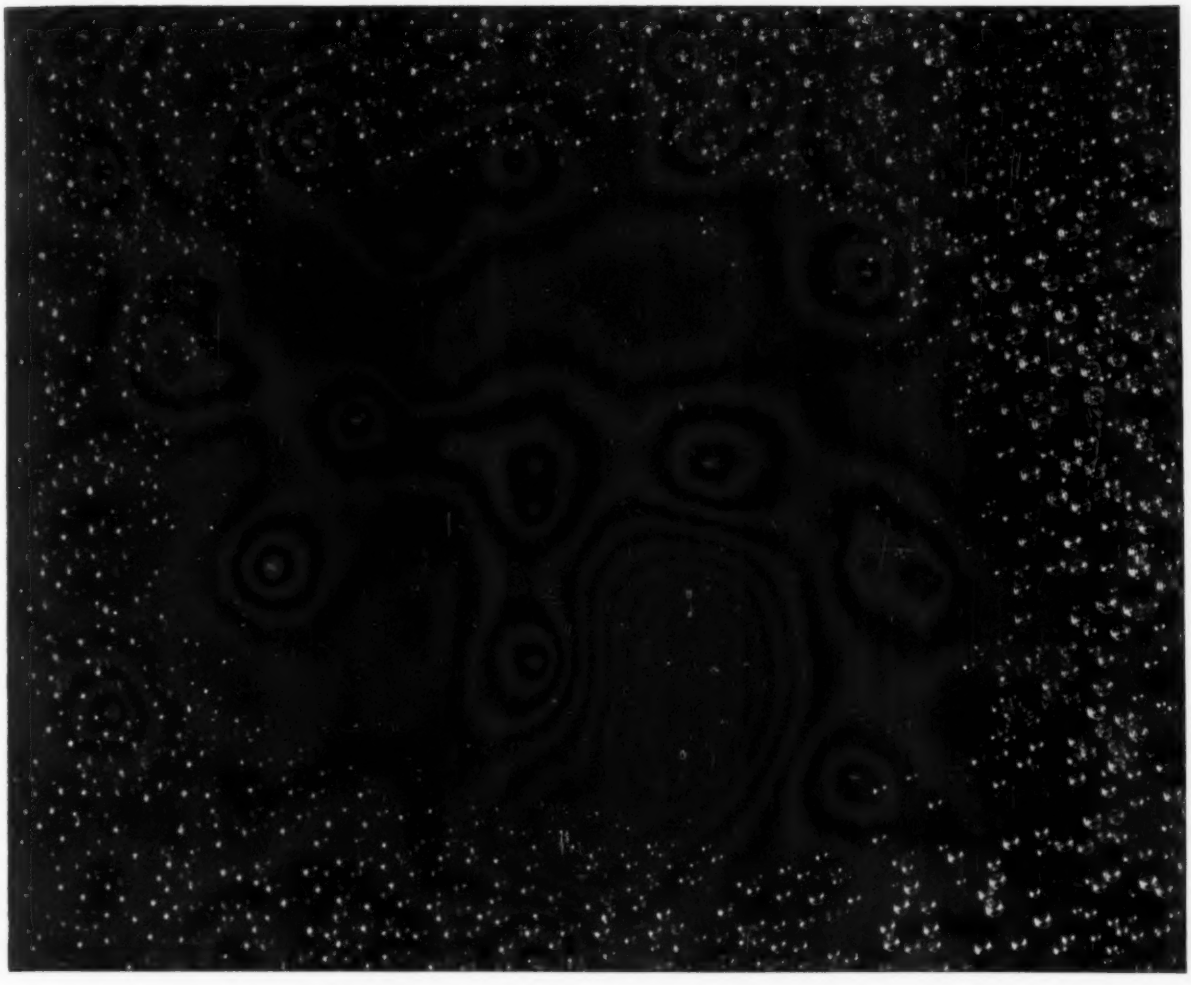
. . . **Alaska-Yukon Refiners & Distributors Ltd.** is the new name of Shamrock Petroleum Co., which plans a 3000 b/d refinery at Haines, Alaska (see PETROLEUM PROCESSING, Nov., 1956, p. 9).

. . . **Standard-Western Operations** (full name, Standard Oil Co. of Calif., Western Operations, Inc.) has been formed as a wholly-integrated subsidiary to manage Standard Oil Co. of Calif.'s petroleum operations in the west (refining, production, exploration, transportation, and marketing.)

in Foreign Operations

. . . **Britain and Europe**

A/S Norske Esso's proposal to build a $30-million,



An Inside-Out View

CORROSION INHIBITOR AT WORK

Here's an external view of what takes place internally in refinery equipment. This photograph shows a piece of mild steel. The center has been treated with Polyrad. The entire piece of steel then was immersed in an acidic environment. The tiny bubbles of hydrogen show the beginning of corrosion. But the center portion remains a safety island—thanks to Polyrad.

This photographic impression bears out what most refinery operators already know—that Polyrad is an effective inhibitor. It will economically reduce corrosive damage with an average treatment of about 1 quart of Polyrad per 1,000 barrels of fluid.

Polyrad's powerful detergent action also serves to loosen organic and inorganic deposits, allowing them to be removed in the fluid stream.

All around the refinery, Polyrad can help maintain throughput, increase heat transfer, reduce metal loss, and cut down-time for maintenance. A Hercules technical representative will be glad to explain how Polyrad can be used to combat your specific corrosion problem.

NA56-4

Pine Chemicals Division, Naval Stores Department

HERCULES POWDER COMPANY

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POLYRAD®

FILMING AMINE INHIBITOR

(To obtain more data on advertised products see page 132)

40,000 b/d refinery near Oslo is being studied by the Norwegian government.

DuPont's newly established British subsidiary will build a "multimillion-dollar" neoprene plant near Londonderry. Construction will start this year.

Esso S.A.F. soon will start building its projected 30,000 b/d refinery at Bec d'Ambes, in the Bordeaux area of southwest France. Scheduled onstream by 1959, the new refinery will include a catalytic reformer. **Other plans in France** are to complete a 21,000 b/d catalytic cracking unit at Esso's Port Jerome refinery early this year, and add a catalytic reformer at some unspecified future date.

Imperial Chemical Industries Ltd. has announced more expansion at its Wilton Works in North Yorkshire (see PETROLEUM PROCESSING, Dec., 1956, p. 10). A $16.8-million oil cracking unit; doubling olefins output has been placed onstream. A third unit, for 1959 completion, is expected to increase ethylene output above 100,000 t/yr.

Ruhrbau Mineraloelraffinerie GmbH, Muelheim, Germany, plans a 19,000 b/d refinery in the Duisburg region. Processes will include reforming, polymerization, and diesel oil desulfurization.

. . . Latin America

The Atomic Energy Commission has granted Creole Petroleum Corp. access to certain restricted atomic data.

The ambitious expansion program of Creole Petroleum Corp. (see PETROLEUM PROCESSING, Dec., 1956, p. 12) continues with an $8-million contract being awarded to Foster Wheeler Corp. The contract calls for a 110,000 b/d crude distillation unit to be completed by Oct., 1957 at Creole's Amuay, Venezuela, refinery.

Still more expansion for Creole includes a 500 b/d lube oil plant scheduled for completion early in 1958.

. . . the East

The Indian Government's $46-million ammonium nitrate, heavy-water plant at Nangal will be engineered by Vitro Corp. of New York.

The Jordanian Economic Ministry will invite foreign companies to bid on construction and operation of the projected government-controlled refinery to be built at Al-Zarkaa (see PETROLEUM PROCESSING, Dec., 1956, p. 12).

Teikoku Oil Co. of Japan has plans for ammonia, methacrylate resin, ammonium sulfate and synthetic fiber units if the company's development of natural gas wells in the Lake Biwa region prove successful.

Toyo Soda Industry Co. and Daiichi Bussan, Japanese firms, will jointly form Ethyl Chemical Industry Co. to make tetraethyl lead in Japan.

in Markets and Prices

. . . The products price picture was a much rosier one for the refiner at the turn of the year, because of the Middle East crisis. The international situation touched off a scramble for crude and products throughout the nation, and domestic and foreign sales attributed to the crisis totaled "millions of barrels."

. . . Heavy fuels were by far the strongest of products, and price advances blanketed the nation. Bunker fuel rose to $2.40/bbl at the Gulf. Light fuels also came in for price increases at the Gulf, on the West Coast, and in portions of the Midwest.

The over-all gasoline situation also appeared a little less precarious. There were export calls for low octane grades—they had been a drug on the market for several months. Prices on these grades edged higher as refiners became reluctant to offer at prices lower than they quoted for heating oils. Prices also moved up in California, but in parts of the Midwest quotations slipped as much as 0.5¢/gal. Group 3 prices held, but still were subject to shading.

. . . On the domestic crude front, trade observers read advance rumblings of general crude price increase into an across-the-board boost of 15¢/bbl by Southern Minerals Corp. in seven lower Gulf Coast counties in Texas. California heavy crudes were raised 40¢/bbl, and in the Rocky Mountain area, sour crude prices also were boosted as much as 40¢/bbl.

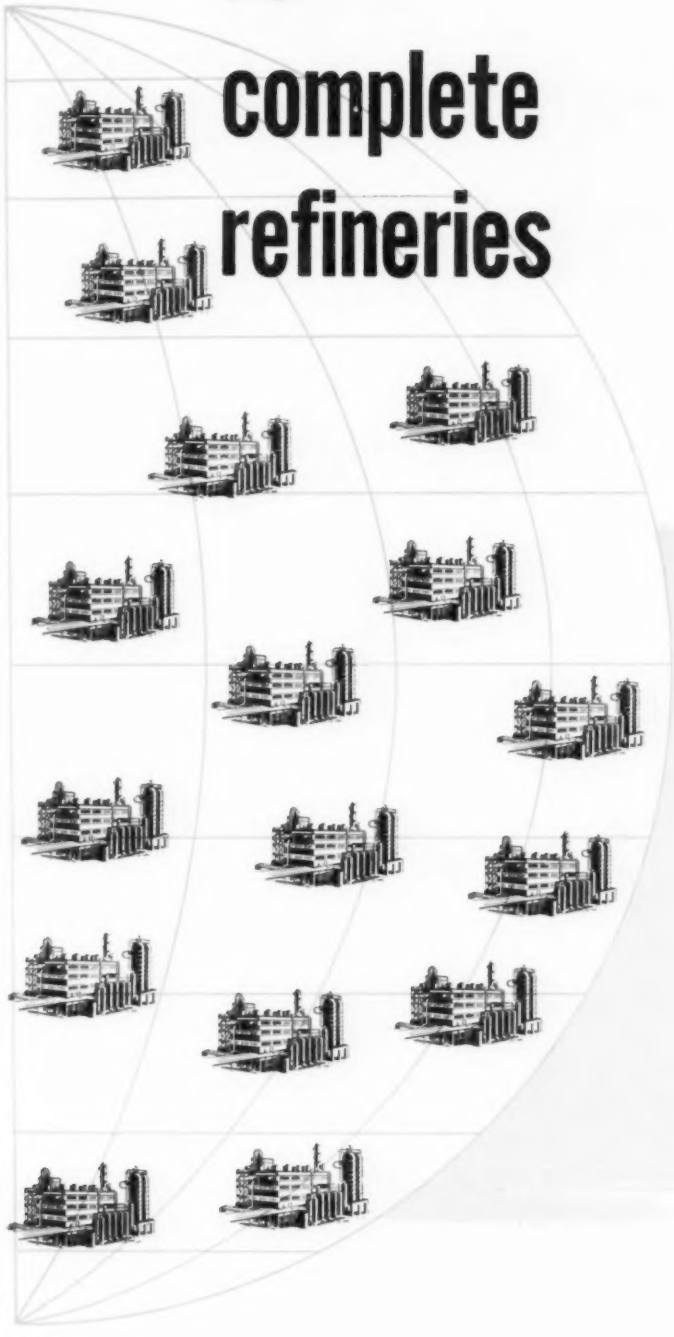
Looking Ahead

. . . Interest in oil shale is up because of the current Middle East crisis. Secretary of the Interior Seaton reports that both industry and the government are giving increased consideration to the long-range possibility of getting oil from shale.

. . . New "exotic" chemical fuels, under experimentation for several years, (see Tomorrow item, p. 15) can produce up to 40% more energy than the same volume of conventional fuels, according to Admiral Arleigh Burke, U. S. Naval Operations Chief. These fuels are believed to use light metal hydrides such as boron and lithium mixed in a hydrocarbon base, and are being tested now for "air breathing" engines and explosives. The Navy is building a $38-million project at Muskogee, Okla., and the Air Force a similar plant at Niagara Falls, N. Y., to make these chemicals.

. . . Petroleum-derived synthetic rubber will have to supply at least 50% of the world's rubber needs by 1965, according to estimates by the Rubber Manufacturers Assn. While world rubber demand is expected to reach 4-million long t/yr in ten years, prospects now are that natural rubber production will not rise above 2-million long t/yr by 1965.

16 complete refineries



1945

1. Refinery for B. P. M. at Cardon, Venezuela.
2. Refinery for Koppartrans Oljeaktiebolag at Gothenburg, Sweden.
3. Refinery for Venezuela Gulf Refining Company at Puerto La Cruz, Venezuela.
4. Refinery for Societe Generale des Huiles de Petrole at Dunkirk, France.
5. "Portable" refinery for U. S. Navy Department.
6. Lube oil refinery for Cit-Con Oil Corporation at Lake Charles, Louisiana.
7. Refinery for International Refineries Inc. at Wrenshall, Minnesota.
8. Refinery for Vacuum Oil Company Ltd. at Coryton, England.
9. Refinery for Burmah-Shell Oil Company at Bombay, India.
10. Refinery for Standard-Vacuum Oil Company at Bombay, India.
11. Refinery for Standard Oil Company (Indiana) at Mandan, North Dakota.
12. Refinery for Suntide Refining Company at Corpus Christi, Texas.
13. Refinery for Commonwealth Refining Company at Ponce, Puerto Rico.
14. Refinery for Esso Standard Oil Company at Antwerp, Belgium.
15. Refinery for Caltex at Visakhapatnam, India.
16. Refinery for Neste Oy at Turku, Finland.

1955

In the past 10 years alone, Lummus has completed or is currently working on 16 complete refineries. Combined, they represent a large percentage of the refinery capacity constructed in the last decade.

But complete refineries are only part of the Lummus story. Separate units for any and all phases of refining from distillation to petrochemical production have been designed, engineered and built by Lummus – as additions to existing installations or as integral parts of new construction.

In the past 50 years, Lummus has added over 700 petroleum and chemical plants and installations to the world's total. Think of Lummus when planning your next project.

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 (To obtain more data on advertised products see page 132)

New Type Catalysts Studied For Hydrogen Processing

CATALYSTS of the future for the now-booming hydrogenation processes may be the "ideal" homogeneous catalysts—catalysts that are physically of the same state and phase as the reactant.

Laboratory evidence hints that these catalysts will be highly resistant to poisoning by contaminants, be highly selective, and will work at lower (hence, more economical) temperatures and pressures. Most importantly, homogeneous catalysts might give some insight into the mechanics of catalysis itself.

Several companies are researching homogeneous catalysts systems,—among them, Houdry Process Corp.—and are also investigating some commercial processes now thought to involve homogeneous catalyst reactions. Researchers feel that activation of molecular hydrogen does not require the existence of a solid metal having properties associated with a group of metalic atoms.

Hydrogen processing, made commercially possible by huge volumes of cheap hydrogen from catalytic reforming operations, has become highly desirable as a feed pre-treating process for these same reformers. Additional uses of hydrogenation in upgrading refinery product streams promises to snow-ball hydrogen treating into a growth even more spectacular than the rise of catalytic reforming.

Present processes involve relatively high temperatures and pressures, demanding costly and critical materials. Homogeneous catalysts, say research men, may dodge the need for these severe conditions and result in lower investments and cheaper operating costs for future hydrogen treating processes. —R.E.C.

Next Jet Fuel—'Hydroborons' In Place of Hydrocarbons?

A SPECTACULAR jet fuel of tomorrow may come from chemical plants rather than from the refinery. Recent laboratory work and present pilot plant production of boranes—liquid hydrides of boron—has proved that these chemical fuels pack more power in a smaller volume than any other jet fuel.

The use of pentaborane, one of the most favored of these new fuels for jet engines, offers three advantages: increased power and aircraft range, reduction in fuel weight and tank volume, and smaller jet engines.

The possibility of combining both hydrogen and boron in a single compound means creating a fuel that has the power capabilities of both elements. Hydrogen has the greatest heat of combustion per pound of any pure material (51,571 Btu/lb) and boron has the greatest heat of combustion per volume of any metal (3,603,000 Btu/cu ft). Together, these two elements make a series of compounds—diborane, decaborane, pentaborane—that combine the power advantage of each.

Pentaborane is already in pilot plant production, with two full production plants on the drawing board. It's the favorite choice among the new chemical fuels. Leading in this development work are Olin Mathieson and Callery Chemical. The new liquid fuel (pentaborane) is lighter than gasoline by 10% and has a heating value about 54% higher. Based on tank volume—an important operational item—pentaborane shows about 17% improvement over kerosine and a 40% gain over gasoline in Btu/cu ft.

The cost of this fuel is forecast at a reasonable level, although well above gasoline. Some claim a cost of less than a dollar per pound is possible. Though this compares unfavorably pricewise with gasoline and kerosine (at 2-4c/lb), the cost of fuel for military uses is not as important as it used to be.

For a typical military mission, cost of fuel is now a small part of the total mission cost, especially for expendable missiles. In this age of atomic and hydrogen warheads, the ability to carry more fuel for delivering a small but powerful load of destruction is uppermost in military planning.

Another value of pentaborane is its high flame propogation speed, which is several times that of hydrocarbons. This means shorter combustion chambers and lighter jet engines, permitting greater payloads.

Although these chemical fuels have tremendous possibilities, and may eventually force hydrocarbon jet fuels into a back seat, they still have development problems. Performance with chemical fuels depends on higher combustion temperatures. This requires new alloys or ceramic coatings, as well as the design of new jet engine combustion chambers. Likewise, the production problems of the boranes pose safety and economic hurdles.

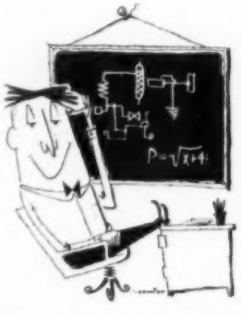
But regardless of these recognized problems, the

potential use of these new chemical fuels is so attractive that both industry and government are pouring immense sums into their development. It may be that tomorrow's jet fuels may not even remember their hydrocarbon ancestors. —W.A.B.

Coming in Instrumentation— Much Needed Basic Research

IT'S GENERALLY accepted that the really great strides in industrial progress are usually the result of deep basic research—in contrast to applied research.

Not that applied research has little practical value; far from it. But rather that most of the important and significant discoveries in science and technology have come from the slower, more methodical, and sometimes "ivory tower" approach, where no monetary value can be placed on the early work done.



A new approach that may help provide more basic research in instrumentation is a project established recently by the Instrument Society of America. ISA will set up a non-profit Foundation for Instrumentation Education and Research.

With its main purpose the determination of areas where basic research is needed, the Foundation will be financed by contributions from individuals, trade associations, technical societies, and companies. Dr. Robert Jefferies, assistant to the president of Daystrom, Inc., who is ramrodding the program, explains its operation:

"Teams of instrument industry men are determining the areas of needed basic research in each major field. Once these programs are decided upon, the research could be conducted by various non-profit research foundations or universities. . . ."

As of now, the Foundation would like to place the basic research programs in universities, although another approach could be through the military.

The current lack of basic research has been mainly caused by a lack of money. It is simply not economically feasible for most instrument companies to move into the expensive type of program basic research represents. True, there has been some joint work done between one instrument manufacturer and one user, say a refining company interested in finding answers to some processing problem.

In most of these ventures, the oil firm pays the bill and the instrument company provides the brain power, though sometimes the oil company also supplies the latter.

Such programs are all too limited in scope, however. Industry will be watching—and undoubtedly supporting——the more ambitious, more basic approach of the Instrument Society of America's project. —W.C.U.

New Liq[uid]-Phase Process Makes Many Oxi[dized] Aromatics Products

A UNIQUE BT[X] [aro]matics oxidation process, sold to Standar[d] [Oi]l Co. (Ind.) by Scientific Design Co., Inc., may push aromatics ahead of olefins as a petrochemical raw material within the next ten years.

The new process, developed by Scientific Design, is a versatile liquid-phase oxidation technique that can be used for a wide variety of aromatic feedstocks, either singly or in mixture, giving the respective dibasic acids.

Most probable process products are phthalic anhydride, isophthalic acid and terephthalic acid (from xylenes) and benzoic acid from any monosubstituted aromatic.

Standard of Indiana bought world-wide rights to the process about a year ago, though few details were revealed at that time. Scientific Design will continue as foreign licensing agent for the process.

A new 60-million lb/yr plant using the SD process will be built for Indiana's petrochemical affiliate, Amoco Chemical Corp., at an undisclosed site, with completion scheduled for 1958. Other users of the process will be the French chemical firm of Pechiney (the first to acquire a license), and an undisclosed licensee in another country. Other foreign companies are interested.

The new process, according to Dr. Landau, Executive Vice President of Scientific Design, could mean that in ten years aromatics will become a larger factor than olefins in petrochemicals. In addition, it will reduce dependence on naphthalene as a raw material for phthalic anhydride. Current supplies of naphthalene (from coal chemicals) are inadequate, requiring that about 25% of our needs be imported from abroad—some from behind the Iron Curtain. —R.L.D.

Edward M. Deasy
ASSISTANT PLANT MANAGER
Thiokol Chemical Corporation
Trenton, New Jersey

"Doc, dermatitis control is simple as 1-2-3-4-5."

An exaggeration?

Not at all. Occupational skin irritation can be prevented. Simply. At surprisingly little cost.

—with the WEST Dermatitis Prevention and Control Program that:

1—insures personal cleanliness
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3—prevents clothing contamination
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5—provides continuous consultation.

THE WEST Program is based on individual shop requirements. It can save hundreds, perhaps thousands, of dollars each year by eliminating medical treatment, enforced idleness, lowered morale, production lags.

"We controlled dermatitis with West's Program"

"Dermatitis no longer troubles our plant employees – now that we're using West's Program of Prevention and Control," says EDWARD M. DEASY, Assistant Plant Manager, Thiokol Chemical Corporation, Trenton, New Jersey.

"At the suggestion of the West Representative, our program includes LAN-O-KLEEN Hand Cleaner to insure personal cleanliness and ANTISEPTIC PROTECTIVE CREAMS to protect exposed skin areas. Since these products have been in use, outbreaks of skin irritations have ceased altogether."

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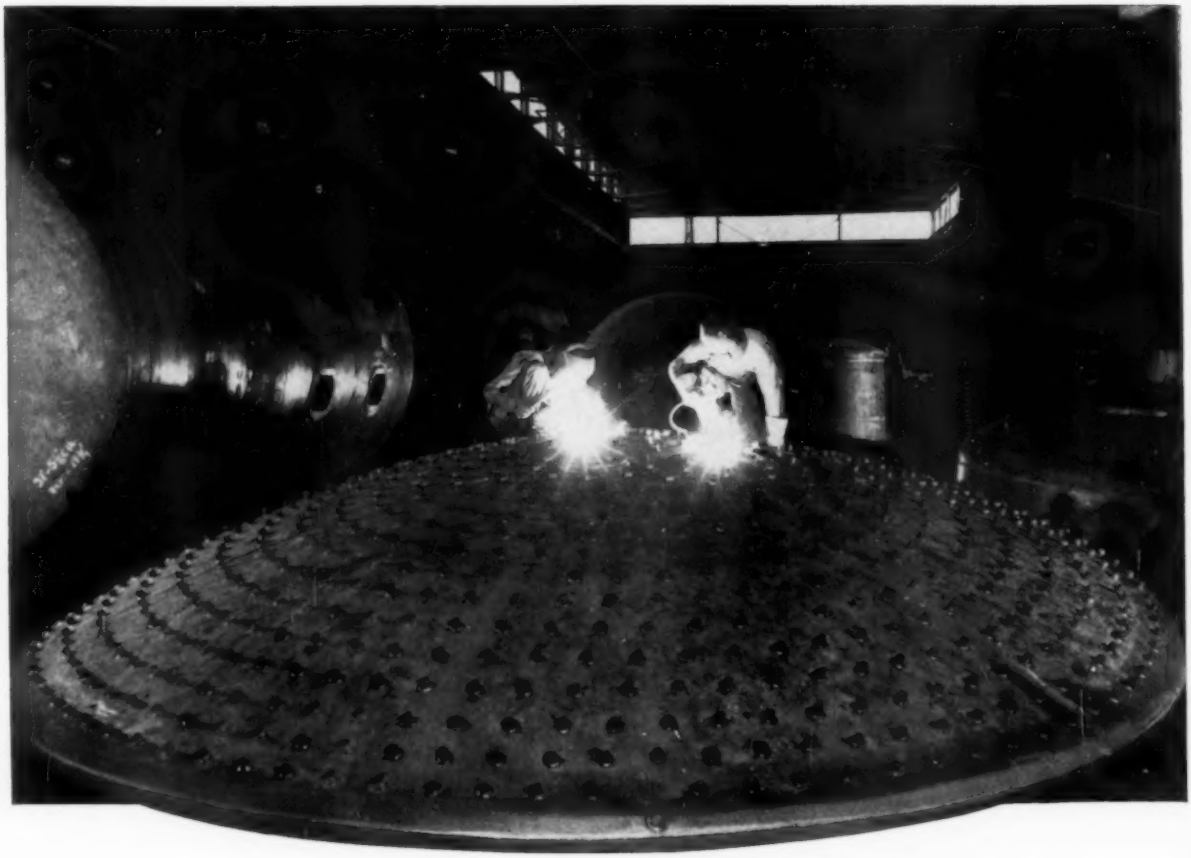

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Hydrogen Processing?

To THE EDITOR: I have read with interest your articles on hydrogen processing (Special Report—"The Petroleum Industry's Future . . . Hydrogen Processing," Nov., 1956, pp. 115-138) and of especial interest to us was the article on page 121, entitled "Tomorrow's Hydrogen Processing." Your paragraph on "desulfurization of whole crudes" was also of interest, because we are working on this problem and have been for approximately one year.

We are quite interested in contacting any company that might be working on the same problem and, if you can, we would appreciate your advising what companies you refer to in your article that may have such installations by 1960.

J. B. Allinson
President
First Development Corp.
1508 Life of America Bldg.
Dallas 2, Texas

● *Anyone have experience in desulfurizing of whole crudes? If so, how about dropping a line to us or to Mr. Allinson. The information on the company we mentioned already planning such an installation was given to* PETROLEUM PROCESSING *in confidence, and cannot be published.*

Hydrogen Kudo

To THE EDITOR: I have seen the special report on Hydrogen Processing which you included in the November issue (pp. 115-138) and wish to congratulate you on a job well done.

W. J. COPPOC
Manager of Research
The Texas Co.
Beacon, N. Y.

● *Thank you, Reader Coppoc. And if any readers would like a few extra copies for their permanent reference files, turn to the Reader Reply Cards, p. 133 this issue. You can order copies at 75¢ each. It's Reprint No.* **R30.**

Likes "Bull Pen"

To THE EDITOR: The sketch on the cover of your August, 1956, issue, and the caption "Do it this way and you won't have to shut her down" is, in my opinion, a classic.

Any production man who has had to keep a plant onstream regardless of the handicaps will appreciate this sketch, and if he has only a smidgen of art appreciation in his makeup he'll want to frame it on his office wall.

I would like to make a couple of corrections to the listing shown in Table 2 of my article on sulfur in the September issue (p. 115). Great Northern Oil Co. should show 58 tons rather than 15; and Continental Oil Co. should be shown as Montana Sulfur and Chemical Co. at 40 tons. These were not errors on your part. This was the information I had at the time the tabulation was prepared.

SEYMOUR SCHWARTZ
President
S. Schwartz & Associates
New York 6, N. Y.

● *Thank you, Reader Schwartz. We liked it too. For more adventures of the Bull Pen see p. 91 in this issue.*

One Small Mistake

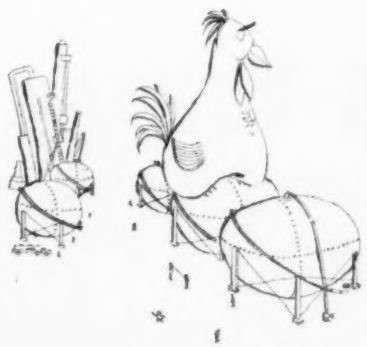
To THE EDITOR: Your report on Heat Exchangers in the March, 1956, issue of PETROLEUM PROCESSING (pp. 101-132) is an education in itself. Also, it is a model of clear presentation of a difficult subject.

There is a mistake, however, in Equation (6) on p. 116. The group should read: $(cu/k)^{1/6}$. You show the exponent inside the parenthesis.

MAX BERGER
Jacobs Engineering Co.
Pasadena, Calif.

● *A sharp-eyed reader has hit the bulls-eye. Mr. Berger is right, although apparently not the first to discover the errant exponent that wandered over the fence. Heat Exchanger Report author Dan Donohue told us someone at his office, Chemical Construction Co., noticed it too.*

● ● ●



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Engine cleanliness! The modern automobile demands better motor oils and your customers are well aware of this fact. Throughout the nation, marketers of Oronite additive compounded motor oils are gaining better sales positions with superior products they market. With Oronite additives you can prove "engine cleanliness" and engine protection to your customers.

Custom-formulation to an individual oil marketer's needs is an Oronite specialty. By tailoring to your base oil and individual needs, you can provide your customers with exclusive, made-to-order motor oils. Why not talk it over with a lube oil additive specialist. Contact the Oronite office nearest you.

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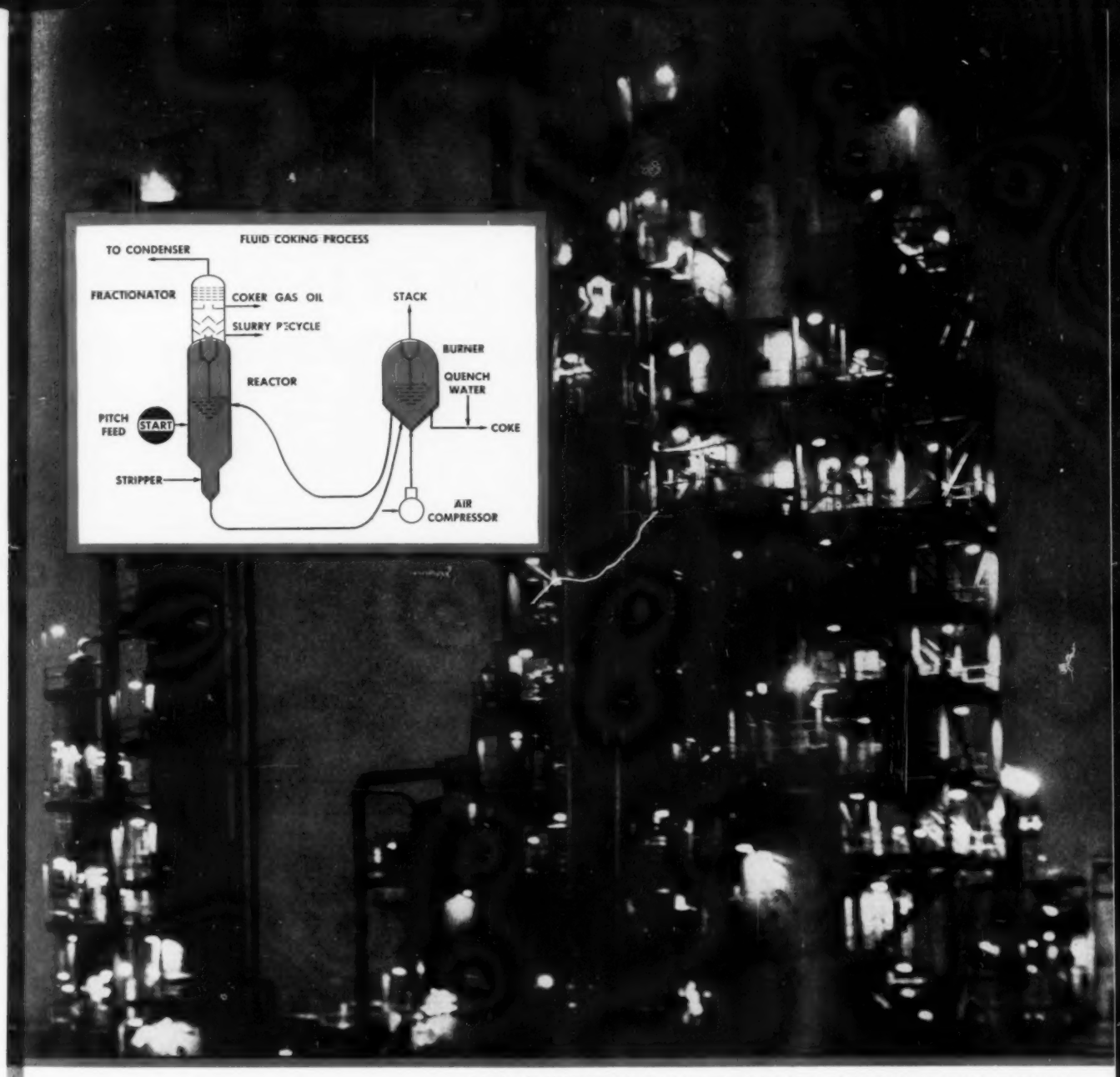

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It results in a higher percentage of gas oils, and makes possible greater ultimate yields of good quality heating oil and gasoline, and smaller amounts of coke than any coking process ever developed. *Fluid Coking* is another achievement of the Esso Research program — 38 years of new process developments made available to refiners around the world.

Investment and operating costs are lower. "Fluidized coke" by-product is used as public utility fuel and in the smelting industry; other new and more valuable outlets have been developed.

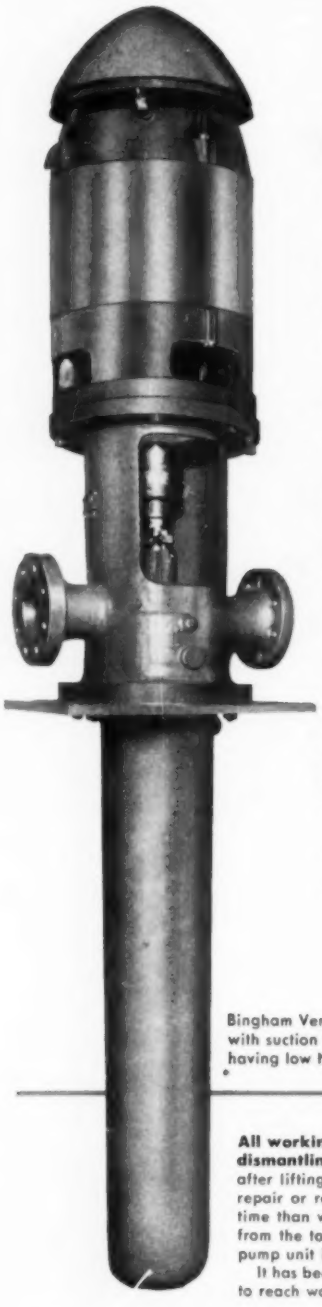
Five *Fluid Coking* installations are on stream; three more will be completed during 1957. Licensees enjoy benefits of continuing *Fluid Coking* research. Flexible *Fluid Coking* can play an important part in helping you process heretofore uneconomical crudes and maintain your refinery balance. We would welcome your inquiry.

ESSO RESEARCH AND ENGINEERING COMPANY

15 West 51st Street, New York 19, N. Y.

Your key to progress... an Esso Research process

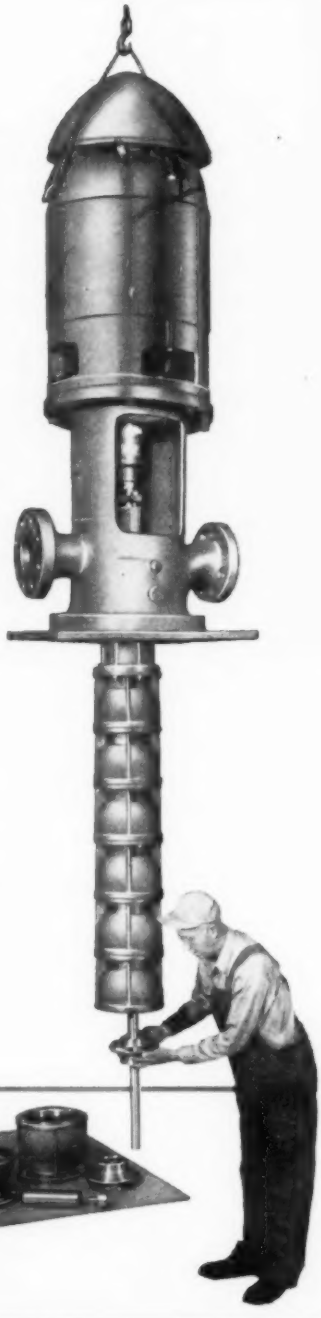
NEW! Bingham ALL WORKING PARTS



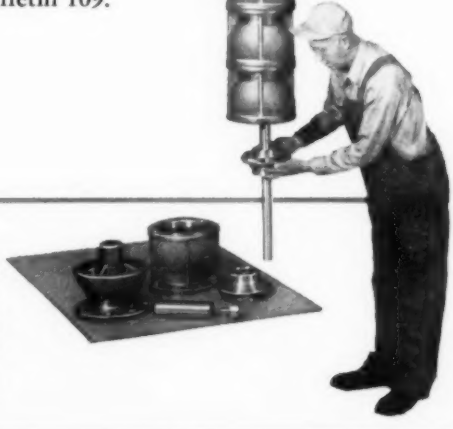
Besides bottom dismantling, which in itself greatly reduces maintenance time when attention is required, this new Bingham pump incorporates advanced design features which minimize maintenance, reducing the need for periodic inspection.

For example, all intermediate bearings (supplied of appropriate material for different pumpages) are forced-lubricated by the pumpage. Bottom bearing is lubricated even if the pump runs dry for short periods. This *dependable* lubrication greatly prolongs the life of bearings, which in conventional pumps are frequently the cause of maintenance shutdowns.

Wherever it has been installed, the new Bingham VCP Pump has given trouble-free service—plus unsurpassed smooth operation with no vibration. Available for any capacity or head. Write your nearest Bingham office for additional information, and Bulletin 109.



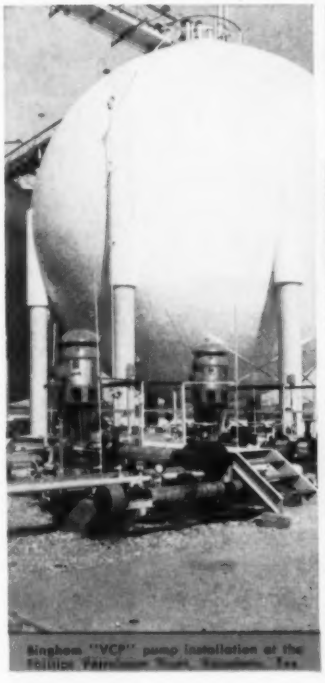
Bingham Vertical VCP assembled with suction well for installations having low NPSH conditions.



All working parts of pump easily accessible with bottom dismantling. One man can service the Bingham VCP Pump after lifting pump from well. By dismantling from the bottom, repair or replacement of any part can be made in much less time than with conventional pumps (where dismantling begins from the top, necessitating removal of driver and head before pump unit is accessible).

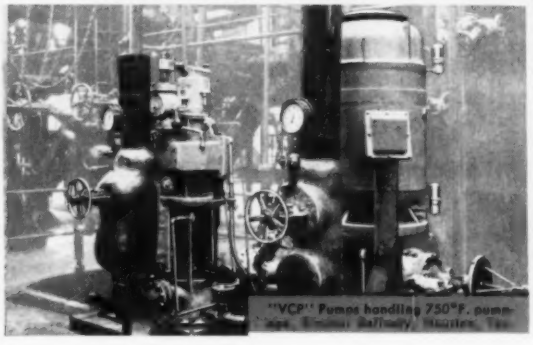
It has been estimated by various operators that time required to reach working parts has been reduced as much as 50%.

VCP VERTICAL PUMP FOR LOW NPSH
ACCESSIBLE WITH BOTTOM DISMANTLING

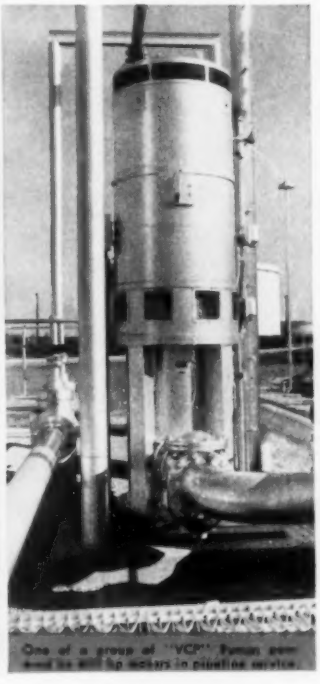


Bingham "VCP" pump installation at the Phillips Petroleum Plant, Sweeny, Tex.

Bingham Type "VCP" Pumps at the



"VCP" Pumps handling 750°F. pump-age, Emeral Refinery, Houston, Tex.



One of a group of "VCP" Pumps pro-vided for 800 hp motors in pipeline service.

Partial list of major oil companies with Bingham "VCP" Pumps in operation or on order:

Ashland Oil & Refining Co.	Phillips Petroleum Co.	Chemical Construction Co.
Gulf Oil Corporation	American Cyanamide Co.	Champlin Refining Co.
Sinclair Oil & Refining Co.	ESSO-Standard Oil of N. J.	Pacific Gas & Electric Co.
Sun Oil Company	British American Oil Co., Ltd.	Socony-Vacuum
The Texas Company	Lakehead Pipe Line Co.	Aerojet General Corp.
Imperial Oil Co., Ltd.	Creole Petroleum Co.	Great Lakes Pipe Line Co.
Shell Oil Company	Humble Oil Company	Kaneb Pipe Line
Deere & Company	Standard Oil Co. of Indiana	Buckeye Pipe Line Co.

Bingham SINCE 1921

DOUBLE VOLUTE PUMPS RADIAL BALANCE

BINGHAM PUMP COMPANY
General Offices: **2800 N.W. Front Avenue, Portland 10, Oregon**
Factories: **Portland, Ore. • Vancouver, B. C., Canada**

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DENVER, COLO.	SEATTLE, WASH.
HOUSTON, TEXAS	ST. LOUIS, MO.
KANSAS CITY, MO.	ST. PAUL, MINN.
LOS ANGELES, CALIF.	TULSA, OKLA.
NEW ORLEANS, LA.	TORONTO, ONT., CAN.

VANCOUVER, B. C., CAN.

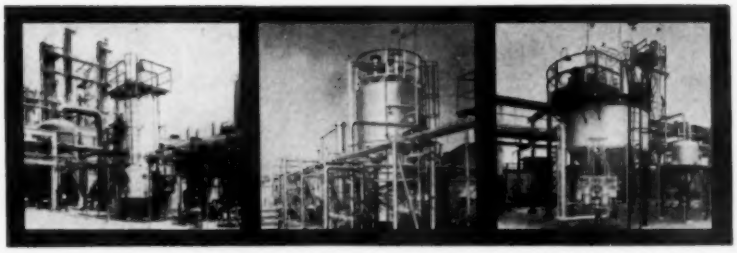
(To obtain more data on advertised products see page 132)

IF YOU CAUSTIC WASH · ACID TREAT · SWEETEN · DOCTOR TREAT · SCRUB · WATER WASH · REMOVE NITROGEN BASES & ARSENIC

PETRECO®

ELECTROFINING

helps you save on installation, operation and insures better products



Petreco Electrofining equipment saves up to 70% on installation, because Electrofining equipment is a once-through, single unit installation. It requires smaller area, less piping, fewer pumps.

Petreco Electrofining is an automatic continuous process, insuring economical operation. Precision controls assure that the distillate is contacted with exactly the correct amount of treating agent in the proper intensity, for a set, pre-determined time. This precision treating gives a clean separation of hydrocarbon and chemical agent phases, minimizing carry-over and product losses.

Electrofining insures a better product by removing the reaction products of chemical treatment which normally contribute to the haze problem. Total metals in the Electrofined product average less than 1 PPM, and the product easily passes market specifications such as Federal Alkalinity Tests, etc. Get complete information today. JUST CALL OR WRITE —

PETRECO®

A DIVISION OF PETROLITE CORPORATION

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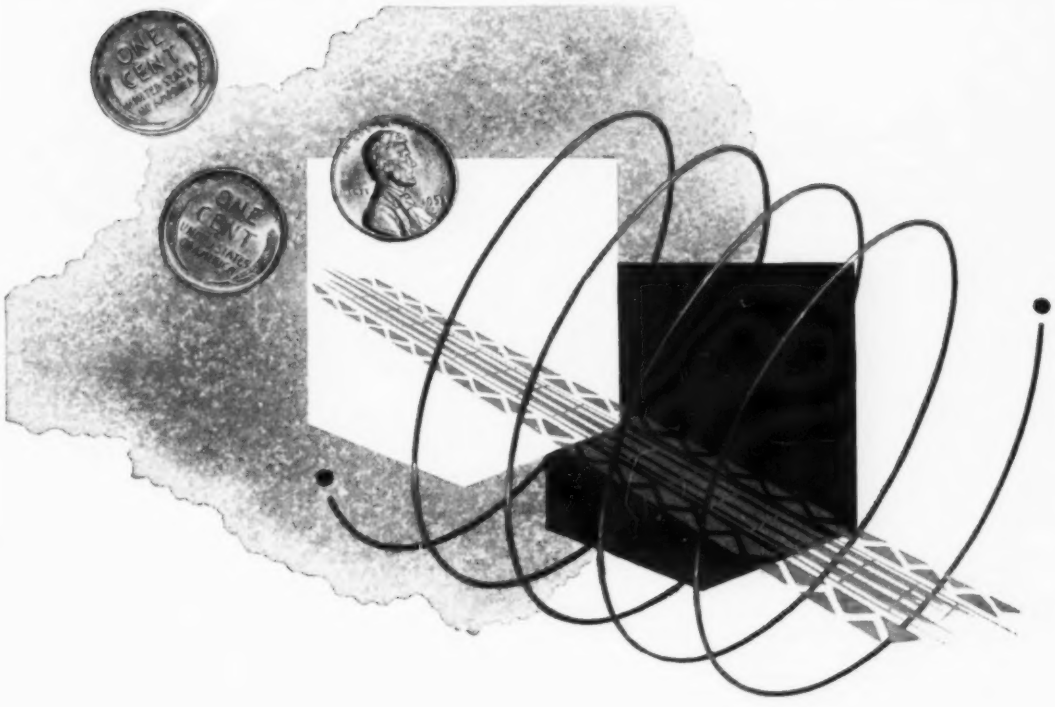
1390 E. Burnett Street, Long Beach 6, California

DT6-38



QO® FURFURAL OFFERS FLEXIBILITY, HIGH RECOVERY, AND LOW SOLVENT COST IN EXTRACTION OF BUTADIENE

QO Furfural has the unique ability to alter relative volatilities of butadiene and other C_4 hydrocarbons. This permits easy separation of compounds differing in degree of unsaturation.

Special advantages of using furfural include:

FLEXIBILITY: Furfural is effective in separating butylenes as well as butadiene, thus a furfural unit can be used to prepare both alkylate stock and butadiene. The process employs petroleum-type equipment, which can be adjusted to a variety of operating conditions.

HIGH RECOVERY: Good selectivity of the solvent assures high butadiene recovery; excellent stability of the furfural assures almost quantitative recovery of the solvent itself.

LOW SOLVENT COST: QO Furfural is produced in large quantities from agricultural residues—not from the valuable food or fiber portions of the plant. This helps keep prices low and stable.

QO Furfural is a proved, safe, low cost way of producing butadiene of highest purity. Write for information on extractive distillation and Bulletin 203-A entitled Physical Data on QO Furfural.

The Quaker Oats Company
CHEMICALS DEPARTMENT

The Quaker Oats Company — CHEMICALS — QO — CHEMICALS — DEPARTMENT

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Room 539F 120 Wall Street,
New York 5, N. Y.

Room 439F Main P. O. Box 4376,
Portland 8, Oregon

In the United Kingdom:
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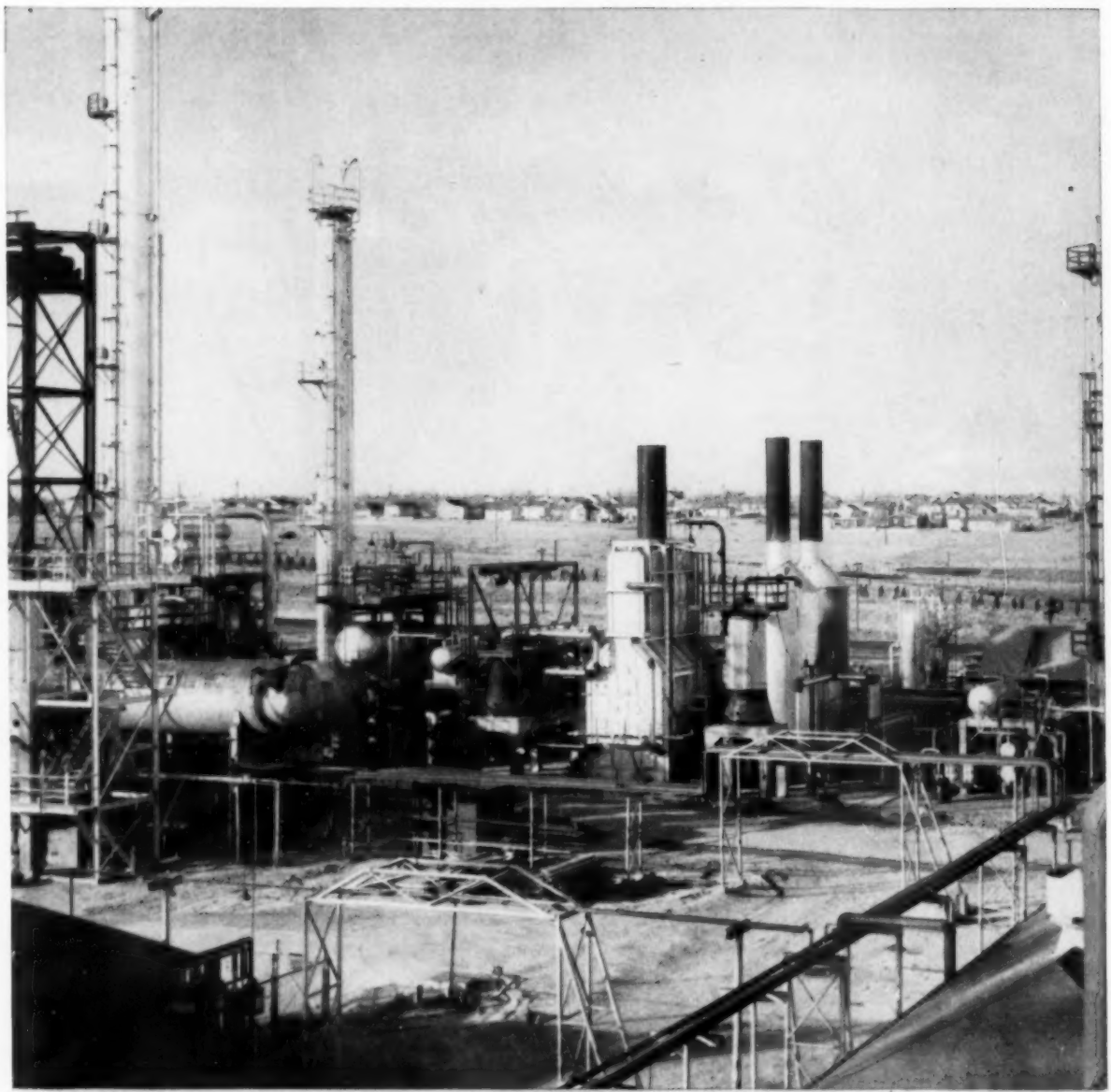
In Europe:
Quaker Oats-Graanproducten N. V., Rotterdam, The Netherlands;
Quaker Oats (France) S. A., 3, Rue Pillet-Will, Paris IX, France;
A/S "Ota", Copenhagen, S. Denmark

In Australia:
Swift & Company, Pty., Ltd., Sydney

In Japan:
F. Kanematsu & Company, Ltd., Tokyo

 (To obtain more data on advertised products see page 132)



Overall view of the UOP Platforming-Unifining units at the Cheyenne (Wyo.) refinery of Frontier Refining Company.

Unifining unit reactor, with reactor charge heater in background.

Frontier engineer adjusts fuel gas control valve on Platformer charge heater.

Unifining Cat Cycle Oil Solves Major Sales Problem For Frontier

By M. H. Robineau
President
Frontier Refining Company
Denver, Colo.

A year of steady progress has been experienced by our company since the installation of two new refinery processing units—a UOP Platformer and a Unifining unit.

M. H. Robineau

Before these processes were added, Frontier had a serious sales problem due to the high sulfur content of our cat cycle oil which made it difficult to market profitably our entire daily production of 1,600 barrels of this distillate. We had two markets for this material—Diesel fuel for the Union Pacific Railroad and No. 2 domestic burner oil.

Since the cat cycle oil as such had a sulfur content of 1.25 weight per cent, it failed in its original state to meet the railroad's specifications. Hence we were forced to blend it in equal proportions with a straight run Diesel fuel—for which we had a ready truck market—in order to produce a fuel which met the UP's standards. This operation was economically undesirable because the straight run Diesel which could have been sold for 11 cents a gallon as truck fuel, had to be blended with cycle oil to make a product acceptable to the railroad and for which we received approximately 9 cents a gallon. Compounding the problem was the fact that after selling the maximum possible quantities to the railroad, truck lines and home heating markets, we had remaining several thousand barrels a month of cycle oil which were sold at sacrifice prices as industrial oils because of the high sulfur content.

Another facet of the problem was a short supply of straight run Diesel oil, and there appeared to be little chance that additional amounts could be obtained from the two crude topping units, whose combined daily capacity approximated 10,000 barrels.

Frontier sought the help of Universal Oil Products Company to improve its distillate stock position. UOP, after extensive engineering and pilot plant studies, recommended that we install a Unifining unit to operate alternately on a charge of either 3,000 B/SD of straight run distillate or 2,500 B/SD of a 50-50 blend of cat cycle oil with straight run distillate.

Frontier "bought the idea." However, a major obstacle had to be overcome—a practical source of hydrogen. It was decided to add Platforming not only because it would provide an economical source of hydrogen but because it would also substantially improve the overall octane rating of the refinery's gasoline and would effect considerable savings in the quantities of tetraethyl lead used for motor fuel blending purposes.

The contract for constructing the units was awarded to Procon Incorporated, and work was completed on schedule. With the aid of electronic instrumentation (Frontier is the first U. S. refinery to have liquid level indications completely transmitted by electrical impulses to the graphic panel), the units were lined out in relatively short time. Operation of the Unifining unit differed from the original schemes from the beginning. Instead of running on one of the alternate operating plans, cat cycle oil was charged to the unit and it ran on this feed for approximately two months.

Unifining this oil brought notable results. More than 90 per cent of the sulfur was removed, the bromine number was sharply reduced, compatibility was improved, and the cetane number and Diesel index were increased so that more cat cycle oil could be blended off into a higher priced product. The net result was the elimination of a product which formerly was sold at sacrifice prices in favor of one which required no special blending to make it 100 per cent salable.

With the Platformer, Frontier has increased by three numbers the octane ratings of its gasolines while substantially reducing its requirements for tetraethyl lead. The ease of octane improvement inherent to Platforming has made it possible to use natural gasoline, previously employed to upgrade octanes, more profitably elsewhere in the refinery.

The successful operation of the Platforming and Unifining units has given Frontier a new impetus which has been reflected in a more economical refinery operation and a greatly expanded marketing program, the latter by virtue of our ability to offer to the public a variety of products much higher in quality than had been possible previously.

Frontier combines UOP Platforming and Unifining processes for increased operational economy and expanded marketing program

designed, engineered and licensed by

UNIVERSAL OIL PRODUCTS COMPANY

UOP

30 ALGONQUIN ROAD
DES PLAINES, ILL., U.S.A.

Forty Years Of Leadership In Petroleum Refining Technology

(To obtain more data on advertised products see page 132)

JACK B. RINCKHOFF (right), Chief Engineer, Sulphuric Acid & Phosphates Dept., Chemical Construction Corp., N. Y. City. Left, Michael De Piano, New York Cooper Alloy Representative.

RINCKHOFF OF CHEMICAL CONSTRUCTION

answers 3 questions on Cooper Alloy Valves

Q. Mr. Rinckhoff, in specifying equipment for the H_2SO_4 plants that Chemico constructs around the world, what Cooper Alloy valve models do you buy most of?

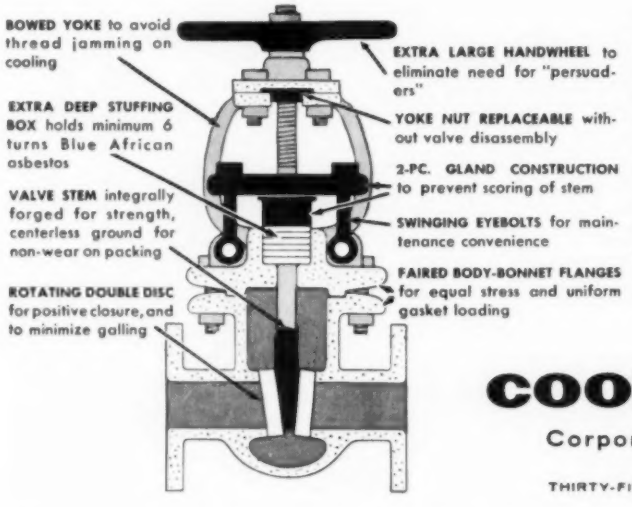
A. Over 80%, I'd say, are OS&Y type gate valves, in sizes 1"to 8"

Q. What's your most important reason for buying Cooper Alloy valves?

A. Availability. Your chain of distributors across the country and in remote parts of the world is of great importance to us. In foreign construction we have often specified Cooper Alloy because of this all-important availability.

Q. What about design and quality?

A. Vital. Valve design determines performance, and our specifications are rigid. As a construction company, we can't afford to jeopardize our reputation by installing questionable equipment. Cooper Alloy valves have passed our tough specs, and have my approval for all severe construction applications.


BOWED YOKE to avoid thread jamming on cooling
EXTRA DEEP STUFFING BOX holds minimum 6 turns Blue African asbestos
VALVE STEM integrally forged for strength, centerless ground for non-wear on packing
ROTATING DOUBLE DISC for positive closure, and to minimize galling
EXTRA LARGE HANDWHEEL to eliminate need for "persuaders"
YOKE NUT REPLACEABLE without valve disassembly
2-PC. GLAND CONSTRUCTION to prevent scoring of stem
SWINGING EYEBOLTS for maintenance convenience
FAIRED BODY-BONNET FLANGES for equal stress and uniform gasket loading

A VALVE DESIGNED FOR STAINLESS!

The Cooper Alloy valve is not an adaptation of earlier brass and iron patterns. Cooper Alloy, with over 35 years of experience in handling stainless steel, created a valve *designed to be cast in stainless!* **Check the Special Design Features shown at left.**

As the little CA man below is saying: *"You can tell a Cooper Alloy Valve as far as you can see it!"* Write today for *your* copy of our folder "Design Factors In Stainless Steel Valves." The Cooper Alloy distributor near you will be glad to show you the complete line of Cooper Alloy valves *and fittings*, and their advantages. He can serve you promptly from local stocks.

COOPER ALLOY

Corporation • Hillside, New Jersey

VALVE & FITTING DIVISION

THIRTY-FIVE YEARS OF STAINLESS STEEL PIONEERING

(To obtain more data on advertised products see page 132)

DU PONT *Petroleum Chemicals* NEWS

One of a Series of Bulletins for the Petroleum Industry

JANUARY 1957

New Du Pont presentation will inform public on oil industry

DU PONT VICE-PRESIDENT

JOHN F. DALEY, a director of the American Petroleum Institute and a member of the Institute's General Committee, Division of Refining, was recently appointed a vice-president of the Du Pont Company.

Mr. Daley joined the Du Pont Company in 1915 as a timekeeper in the explosives plant at Carney's Point.

When made a vice-president he also became a member of the executive committee and director of Du Pont. Prior to holding these positions, Mr. Daley was general manager of the Organic Chemicals Department, which includes the Petroleum Chemicals Division.

In 1940, Mr. Daley's experience in explosives manufacture was made available to the government. During the war, he served as manager of the Indiana Ordnance Works and as deputy field director of ammunition plants, with jurisdiction over 55 government-owned plants. For this work, he was awarded a commendation for exceptional civilian service by the Secretary of War.

He returned to Du Pont as director of pigments sales in 1944, later becoming general manager of the Pigments Department. He was appointed general manager of the Organic Chemicals Department in 1948.

A clear, concise—yet highly dramatic—explanation of our American business system is packed in the small, lightweight briefcase pictured below. It's a presentation kit with a story woven closely around oil industry products and activities. Tentatively, it has been named "A 'Brief' Case for Business."

The theme of the story is that the *customer* actually makes the important business decisions today. It also points up very clearly the interdependence of big and little businesses in filling customer needs.

PETROLEUM PLAYS an important part in the production of all the items in this presentation kit. And the entire kit fits compactly into the lightweight easy-to-carry briefcase.

This public relations presentation—prepared by the Du Pont Petroleum Chemicals Division—shows how oil is truly the lifeblood of American industry. Yet its points are made in such a way that they are applicable to almost any segment of our economy. The audience appeal of this presentation is, therefore, exceedingly broad.

"Magic Barrel" idea

The new briefcase kit tells an oil industry public relations story in much the same way as the popular "Magic Barrel" has been doing so successfully for a number of years.

The briefcase is not meant to replace the "Magic Barrel," which will be continued. Rather it is to supplement that program. It can be presented to groups who have already seen the Barrel, or where the Barrel is for some reason not feasible or appropriate. The new presentation has been streamlined, including fewer items than the Barrel. These items, however, have been carefully selected to tell the story forcefully.

Low cost

Another advantage of the briefcase is its low cost . . . only $50 including all the products in it.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

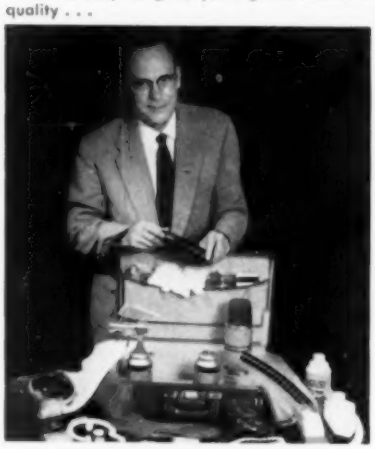
DU PONT *Petroleum Chemicals* NEWS

CONTINUED

New Presentation

Within the oil industry, there are now about 1200 speakers trained to give the "Magic Barrel" presentation. These men and women can, with practically no additional training, present the new program. And to acquaint them quickly with the new kit, we are supplying complete instructions as well as an easy-to-follow script.

THE NEW petrochemicals presentation is easy to learn, easy to give, yet high in dramatic quality . . .



H. C. THOMPSON, assistant promotion manager, demonstrates.

Now available

This new presentation is being sponsored by the Oil Industry Information Committee. To order these kits, or for further information about them, just get in touch with one of our representatives at the nearest Du Pont Petroleum Chemicals Division office listed below.

We will also be glad to train as presentation speakers—at no cost to refiners—any personnel who are not familiar with this type of public relations program.

DuPont Estersil GT solves problem of "leaking greases"

Crane and power shovel operators, among others, are reporting unusually satisfactory results from greases made with Du Pont Estersil GT (grease thickener).

One contracting company, for example, wanted a grease which would not leak on hoist drum brake bands, particularly at high ambient temperatures. A number of different greases were tried with no success in solving the problem.

The contractor's petroleum supplier then suggested an estersil-based grease. This type of grease will not break down even under severe high-temperature, high-shear working conditions.

The experiment was an outstanding success. The estersil grease was used on three different crane hoists. In all cases, the leakage problem was completely solved.

Conversely, estersil greases also have properties that are the answer to many extremely low-temperature lubricating problems. Since wide temperature changes produce little change in their consistency, there is little danger of estersil greases losing their lubricating value in sub-zero temperatures.

High water resistance

In addition to outstanding thermal stability, estersil greases have "built-in" water repellency and superior mechanical and oxidation stability. They also have superior handling qualities and can be easily manufactured.

Du Pont Estersil GT is now available in commercial quantities. Any of our representatives will be glad to give you samples and more complete information. Call the sales office nearest you.

Film dramatizes oil industry expansion

"It Never Rains Oil" is an animated color cartoon about a very serious subject.

It tells how percentage depletion helps to keep oil production ahead of the world's mushrooming demand. You have probably seen the film and of course know the value of percentage depletion.

However, the point of this suggestion is—shouldn't *more* and *still more* people be informed on this important subject?

Movie prints are still available for your use. In case you know of some other groups who should see it . . . new personnel employed over the past two years, for instance . . . write for the film.

Planned and produced by the Du Pont Petroleum Chemicals Division, the film is sponsored and distributed by the American Petroleum Institute, Independent Petroleum Association of America, Mid-Continent Oil and Gas Association, Rocky Mountain Oil and Gas Association and Western Oil and Gas Association.

Big and small businesses work together

The tremendous amount of business generated by "big business" for "small business" is pointed up in a new survey by the Du Pont Company. It shows that small firms represent 90% of Du Pont's 75,000 customers and 30,000 suppliers.

DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry

E. I. DU PONT DE NEMOURS & COMPANY (INC.) • PETROLEUM CHEMICALS DIVISION • WILMINGTON 98, DEL.

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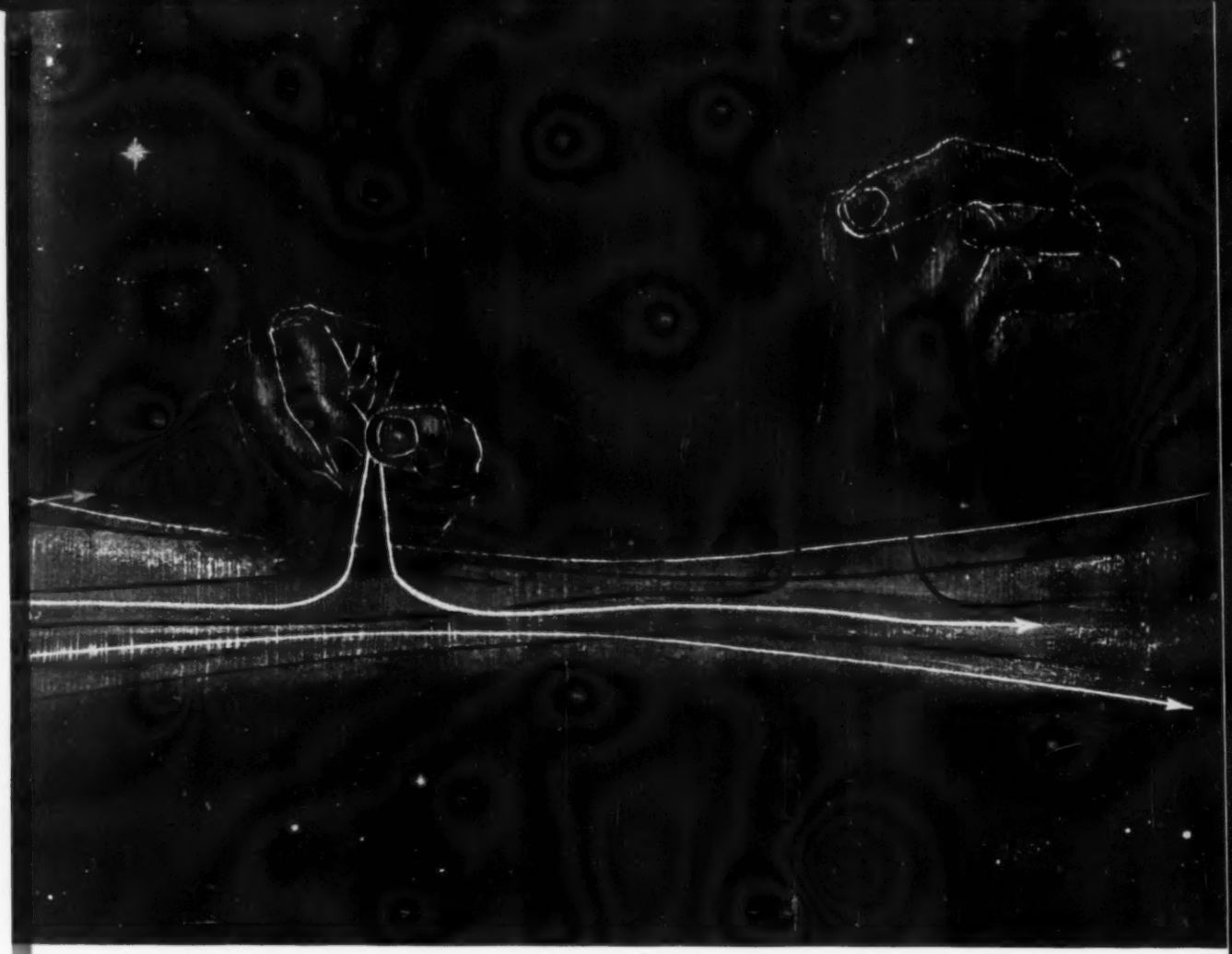
OVER

Serial No. A-3266

Printed in U.S.A.



the analytical technique of tomorrow...

CONTINUOUS GAS CHROMATOGRAPHY

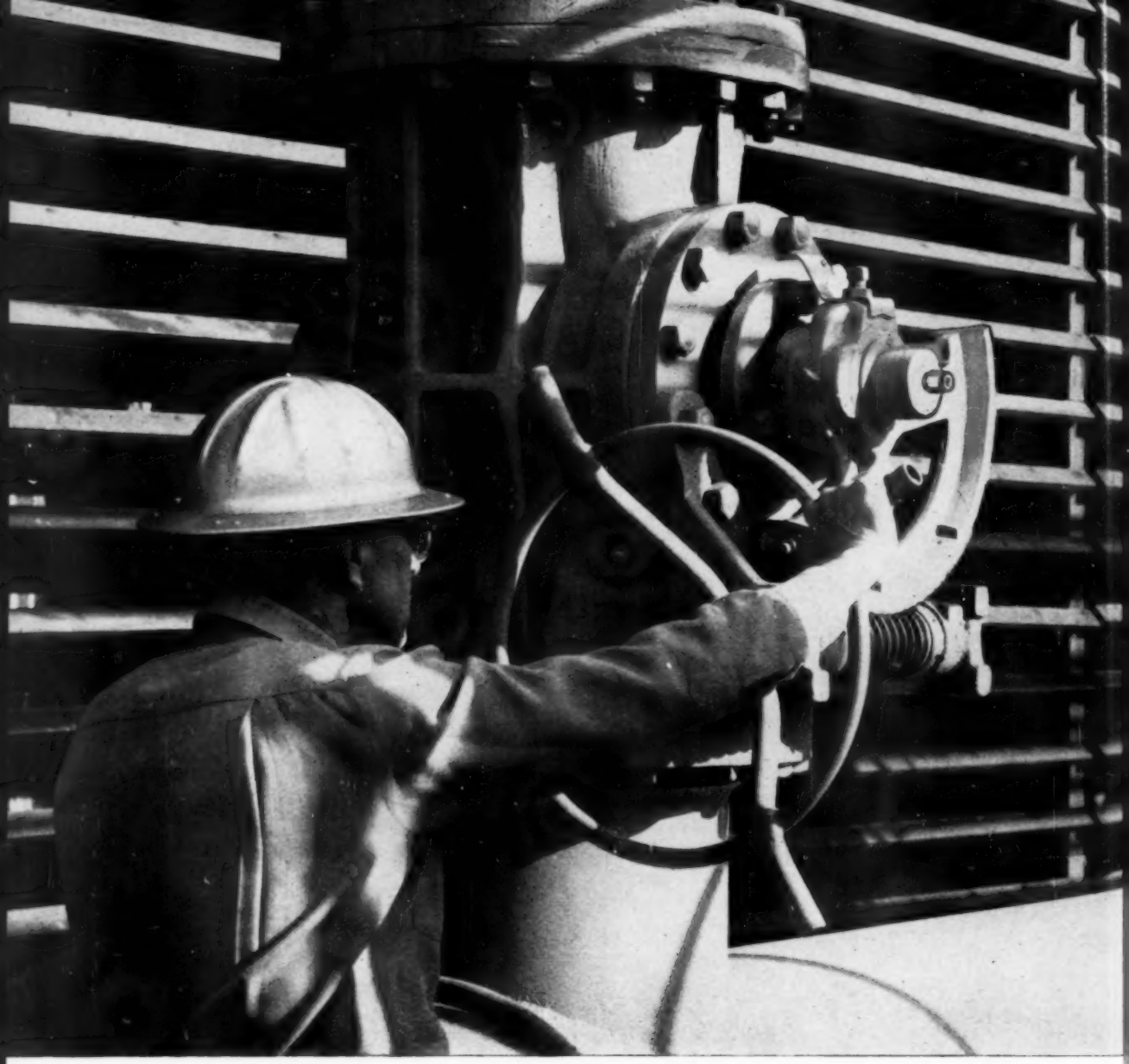
ready for your process stream today!

In the past twenty years, no single achievement has been more significant to the field of Process Control than the perfection of the technique of CONTINUOUS GAS CHROMATOGRAPHY. This remarkable new method brings a new level of reliability to plant stream analysis – and with it, simplicity unequalled by any other analytical technique. Many authorities have predicted it will bring about a revolution in continuous process control – through improved product quality, and increased yields.

Now, as a result of the advanced development work of a leading chemical company ... precision engineering by Watts Manufacturing Company, Ronceverte, W. Va.... and application engineering skill and national sales and service by Beckman Instruments, Inc. – a fully-engineered, thoroughly tested CONTINUOUS GAS CHROMATOGRAPH is available for delivery to your plant – *months ahead of the most optimistic schedules.*

To obtain full information about this important new instrument, write Beckman Instruments, Inc., Process Instruments Department, Fullerton, California. Ask for Data File N-29-23.

Beckman / *process instruments*



Reduce Down-Time Costs

with ROCKWELL-Nordstrom VALVES

The two most common valve problems that cause excessive down-time costs are seat failure (leakage) and wear. Performance records in thousands of refineries and gasoline plants prove that Rockwell-Nordstrom valves cut down-time costs because they *stay leakproof* and *wear longer in service* than any other valve. In Rockwell-Nordstrom valves, there are no exposed seats to be cut-out or corroded. Leakproof, positive shut-off is assured by pressurized lubricant sealing. Lubricant also eliminates the metal-to-metal friction that causes ordinary valves to wear out so quickly.

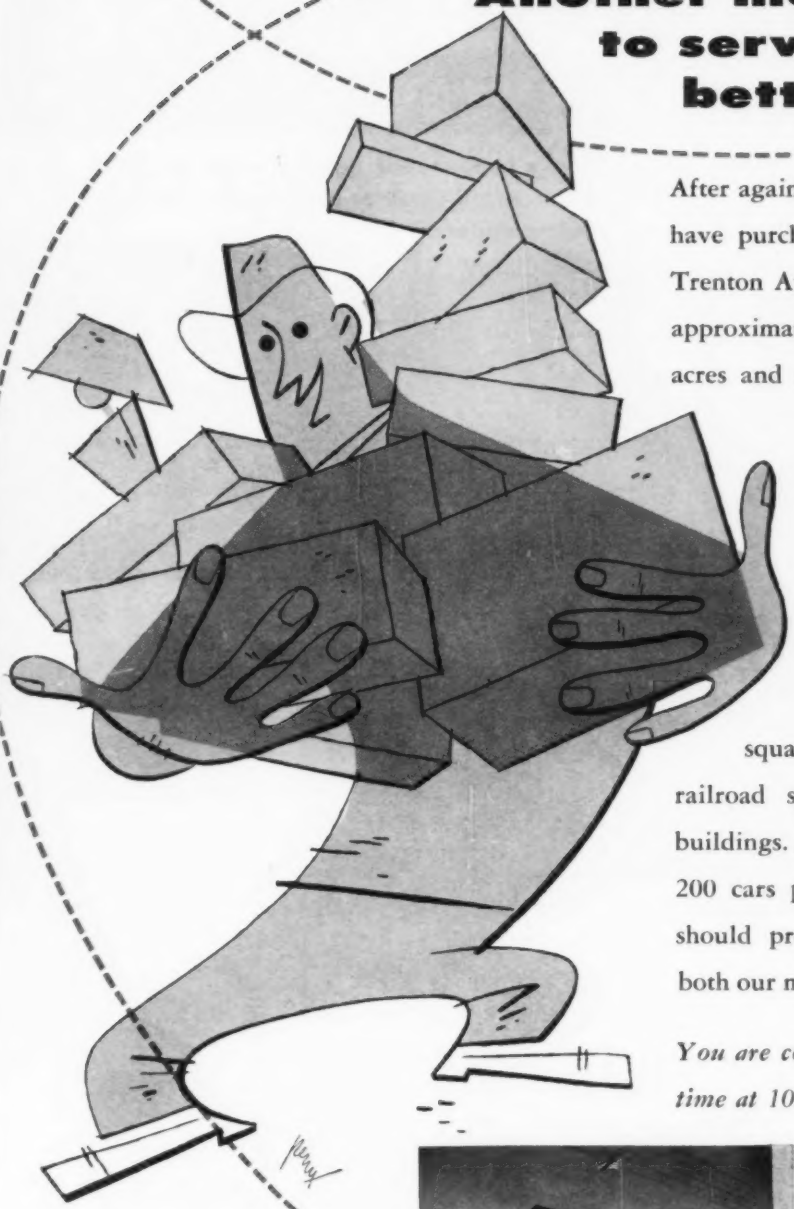
The low maintenance cost and dependability of Rockwell-Nordstrom valves is a matter of record, yet they cost no more to buy, often less, than ordinary valves. Available in a complete range of sizes and pressure ratings. Write today for more information: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Canadian Valve Licensee: Peacock Brothers Ltd.

ROCKWELL-Nordstrom **VALVES**

Lubricant Sealed for Positive Shut-Off

Another move, to serve YOU better . . .



After again outgrowing our quarters, we have purchased property at 108 North Trenton Avenue, in Tulsa, consisting of approximately three and one quarter acres and several buildings. The main office building contains in excess of 14,000 square feet. Our rapidly expanding engineering department will be housed in a separate two story building with about 37,000 square feet. We have our own railroad spur and equipment storage buildings. A paved parking area for about 200 cars permits offstreet parking and should prove a great convenience for both our many visitors and our employees.

You are cordially invited to visit us any time at 108 North Trenton Avenue.

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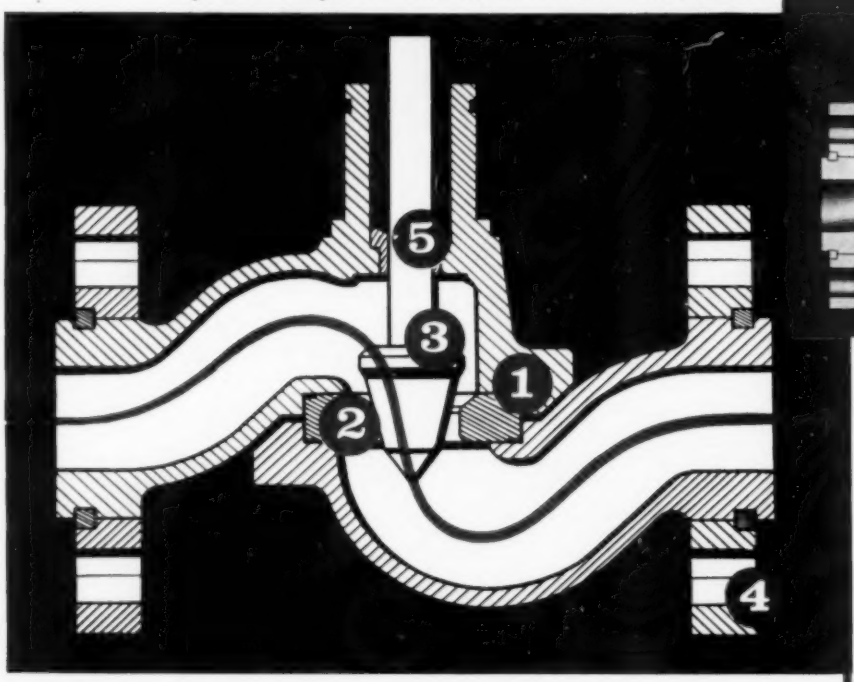
The REFINERY ENGINEERING Company

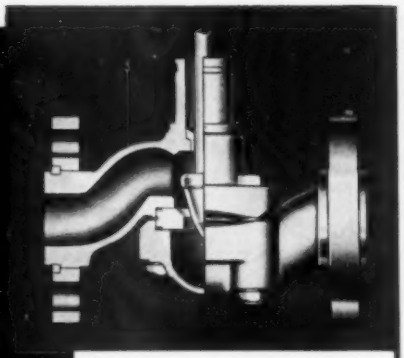
NEW YORK TULSA TORONTO

ANNIN BODY DESIGN

...THE SOUNDEST APPROACH TO TROUBLE-FREE FLUID CONTROL

Reduces body turbulence and erosion • Longer seat ring life—retains tight closure • High lift in all sizes for better control—greater rangeability • Fewer parts—simplified and much lower maintenance.

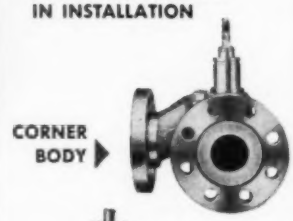


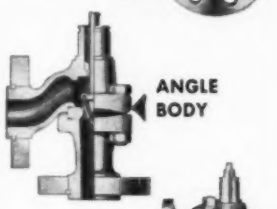


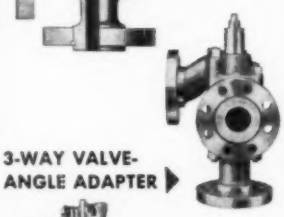
GLOBE BODY ▲

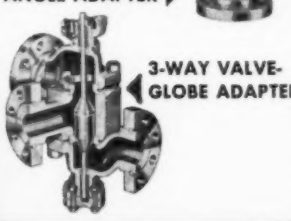
The basic form of all Annin Valves. Reduces number of parts 50 to 75%, lowers initial costs, saves on parts inventory and maintenance.

OTHER BODY DESIGNS PROVIDE FLEXIBILITY IN INSTALLATION









Annin Valves are the answer to the complex fluid control problems common in the process industries—Chemical, Petroleum, Paper, Steam, Power Plants, and many others. Today, Annin Valves are recognized by control engineers and valve designers as the outstanding valve development of the past twenty-five years for the control of hot, cold, erosive, or viscous liquids.

1 BODY. Single seat split body construction eliminates pockets and shoulders... reduces erosion.

2 SEAT RING. The body flanges retain seat in perfect alignment with valve plug.

3 VALVE PLUG AND STEM. Valve plugs are contoured to provide either linear, percentage, or semi-throttle characteristics... reduce turbulence, wire drawing, plug vibration and noise.

4 SEPARABLE FLANGES. Can be interchanged at will. Carbon steel flanges can be mounted on alloy bodies for economy.

5 PLUG GUIDE. Hard metal guides of close tolerances can be inserted through stuffing box without resorting to threads, welding, pressing or staking.

ANNIN THE ANNIN COMPANY
6570 EAST TELEGRAPH ROAD, LOS ANGELES 22, CALIFORNIA
Control VALVES

(To obtain more data on advertised products see page 132)

How to IMPROVE Catalytic Cracker PERFORMANCE

YORKMESH DEMISTERS in Vacuum Towers effectively remove entrained asphalt to provide clean gas oil. The improved catalytic cracker charging stock with decreased carbon and metal contaminants results in —

HIGHER THROUGHPUT rates due to reduced load on the regenerator;

HIGHER YIELDS of liquid products due to high catalyst activity maintained for longer periods.

York engineers will review your operating conditions and recommend the best Demister from the several styles available, which include the new "Triple H" high-efficiency, homogeneous, herringbone Yorkmesh Demister.

WRITE for Bulletin 18 and Case Studies 1001, 1002 and 1004 from our technical library for specific information on vacuum tower installations.

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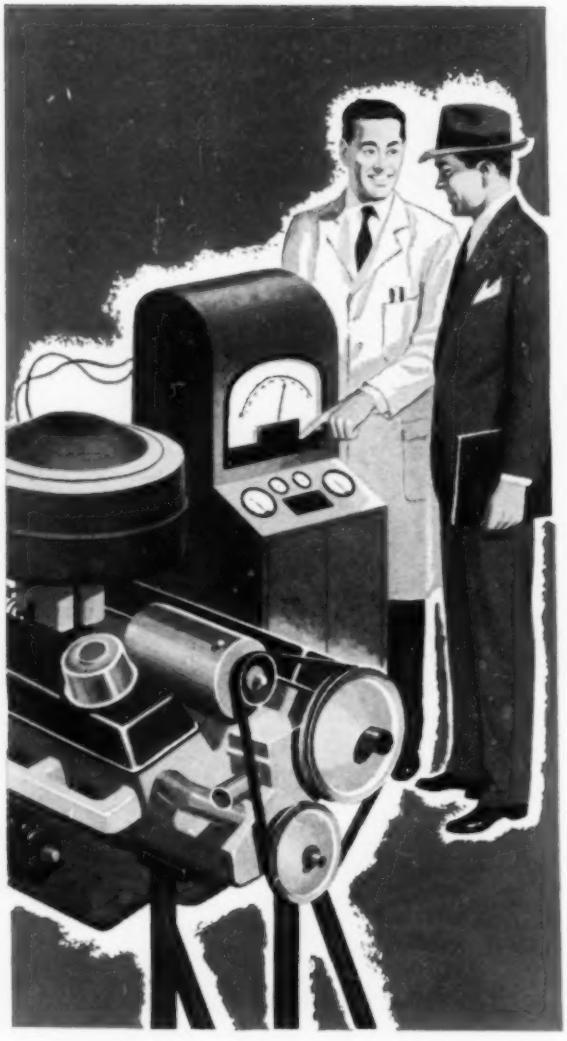
Specialists in **FLUIDS SEPARATION / ENGINEERS and MANUFACTURERS**



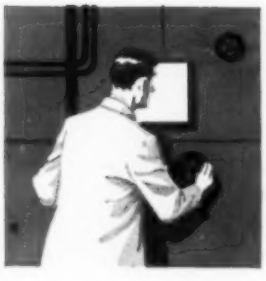
Our Lubrication Engineers worked with Engine Designers, then put

EXTRA anti-wear protection in AEROLUBE® 93-C!

Top anti-wear characteristics are specifically formulated into Cyanamid AEROLUBE 93-C inhibitor to give the extra protection required in engine break-in, severe service or other problem conditions faced by lubrication engineers. This concentrated zinc dithiophosphate inhibitor safeguards stability—it is an excellent oxidation inhibitor that prevents formation of harmful peroxides and organic acids. It sharply reduces wear of valve lifters and other critical engine parts.

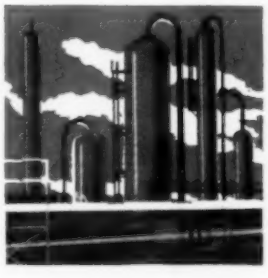
Zinc dithiophosphate has proved itself to be one of the most effective additives for commercial lube oils. Maximum wear resistance, oil stabilization and bearing protection, demanded by modern engines, have been built into Cyanamid's AEROLUBE 93-C.

Light color and compatibility with lube stocks and other additives, make AEROLUBE 93-C outstanding for use in premium oil products—for regular use as well as initial fill.



AERO® HDS CATALYST

In modern hydrodesulfurization processes, Cyanamid's new AERO HDS Catalyst contributes highest available volume activity and excellent mechanical properties. Cyanamid's specialized catalyst know-how may be helpful in initiating or improving your hydro-treating operation.



REFINING RESEARCH

At Stamford, Connecticut, the Refinery Chemicals Department of Cyanamid maintains laboratories unsurpassed in the refining field for basic research and development in catalysts and other refinery chemicals. As a part of extensive research and pilot plant facilities, specialized equipment and methods—such as the electron microscope and vapor-phase chromatography—are used to develop information leading to improved products which give optimum performance under field conditions.

Our field men are constantly absorbing new developments at the research, development and operating levels. In this way, your Cyanamid man keeps abreast of the petroleum industry's dynamic technology and can offer a valuable technical service to refiners.

CYANAMID

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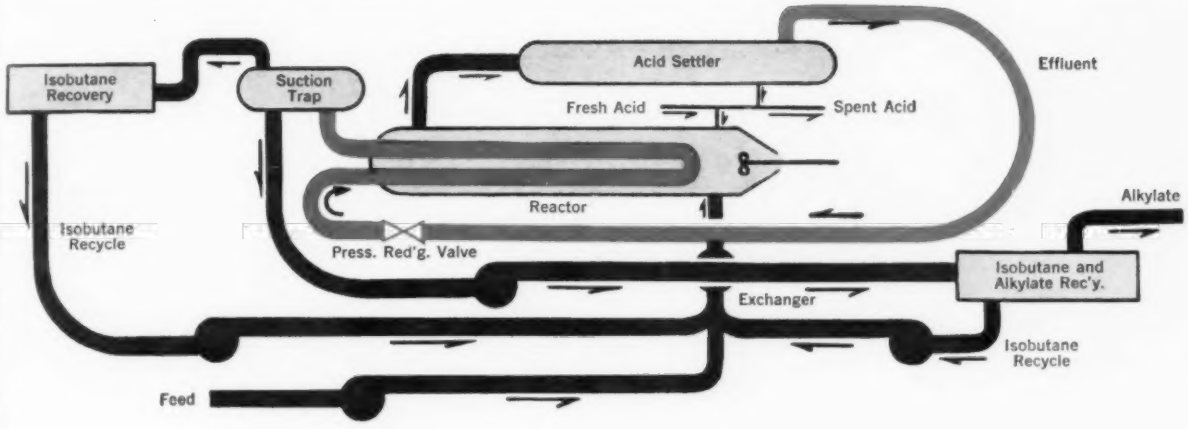
(To obtain more data on advertised products see page 132)

LOW-COST alkylate

FOR MOTOR OCTANE

effluent refrigeration



H_2SO_4 consumption—as low as 0.3 lb per gal of alkylate

EFFLUENT REFRIGERATION, the most important advance in alkylation technology in 15 years, now classifies alkylation as a most valuable process technique for production of the higher octanes. A substantially decreased acid consumption, higher yield of higher octane and a reduction in fractionation requirements for motor alkylate production are the major factors responsible for this most important process improvement.

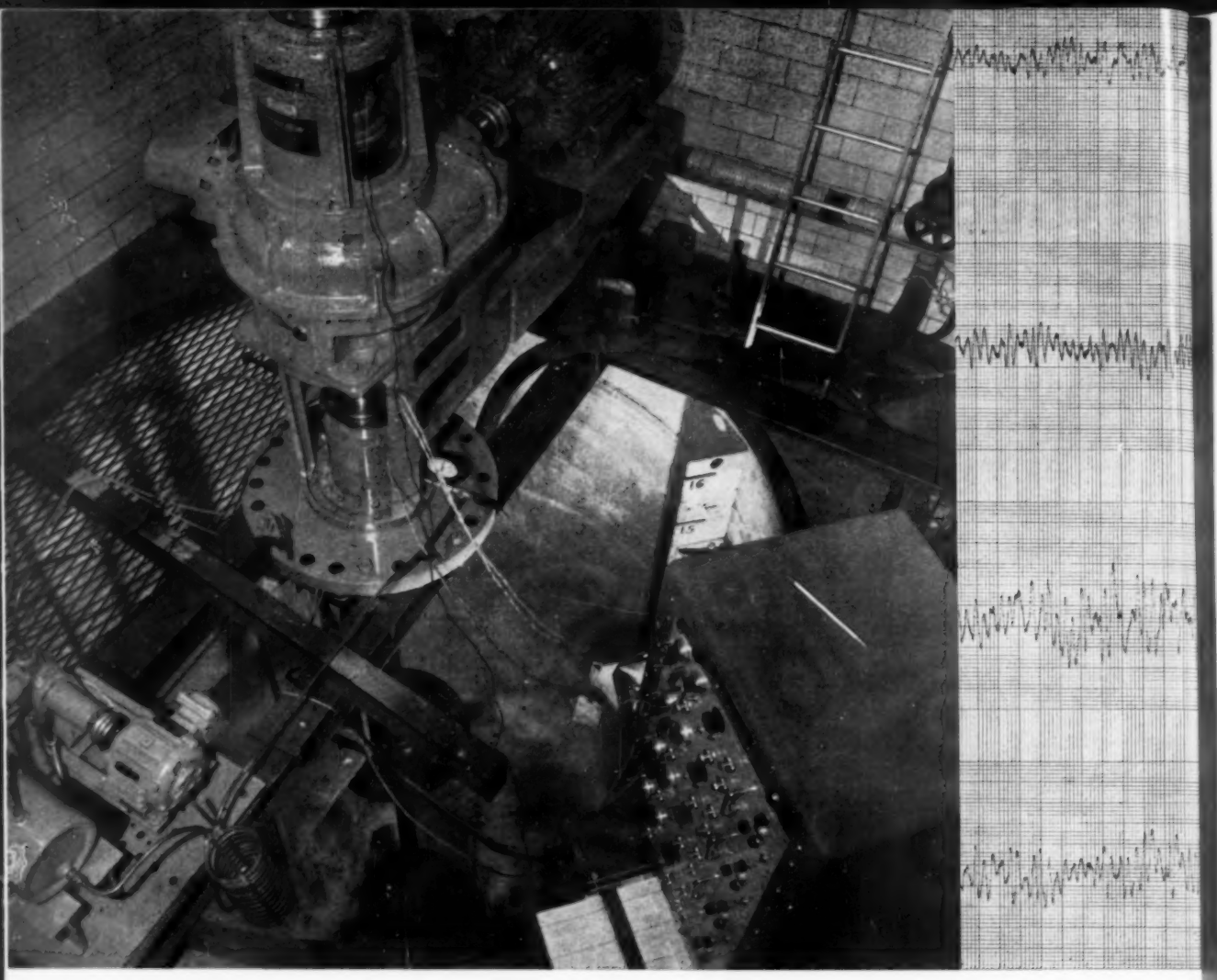
An effluent refrigeration alkylation unit designed by Foster Wheeler is now being constructed for a major mid-western refiner. Capacity, 3,800 bbl per day of motor alkylate.

Flow description: Feed, mixed with recycle isobutane, enters reactor through heat exchanger. Thorough agitation with sulfuric acid, and high-isobutane ratio maintain optimum reaction conditions. Total reactor effluent separates in acid settler, acid returns to reactor. Hydrocarbon effluent from settler flows through pressure reduction valve into cooling coils in reactor maintaining predetermined temperature therein. Vapor and liquid separate in suction trap. Vapor, mainly isobutane, is recovered and returned to reactor. Liquid is pumped through heat exchanger to fractionation system where recycle isobutane and product alkylate are recovered. For further information write to *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

(To obtain more data on advertised products see page 132)



How this shaft deflection test can give you **better fluid mixing**

Some secrets of efficient fluid mixing lie hidden beneath the tug-and-pull of fluids buffeting this LIGHTNIN Mixer's impeller.

These fluid forces are beginning to yield clues that can help you get improved mixer design and lower mixing costs.

Solving the seal dilemma

For example, if you're mixing fluids under pressure or vacuum, you probably want the great operating economy of a rotary mechanical seal.

You want the shaft diameter large enough to run with minimum deflection, to keep the sealing faces accurately aligned—but not larger than *really* necessary.

Seeing what deflection looks like

That is one reason why, as the 4-inch shaft on this 50-horsepower LIGHTNIN test unit revs up toward its natural vibration frequency, four MIXCO-designed strain-gage pickups start "taking the pulse" of the rotating shaft.

At the recorder, four electric styli trace a profile of the frequency and amplitude of shaft deflection during the run, in various liquid depths, and under different conditions of impeller size, location, and tank baffling. The data are accurate to 0.0005 in.

Combined with continuous torque measurements, this composite profile provides basic data for computing the stresses acting in the shaft.

Getting rid of a bearing

Efficient mixer shaft sealing is only one product of these test runs. They also permit highly accurate design of overhung shafts to operate without a steady bearing in the tank bottom, thus eliminating a major maintenance cost item.

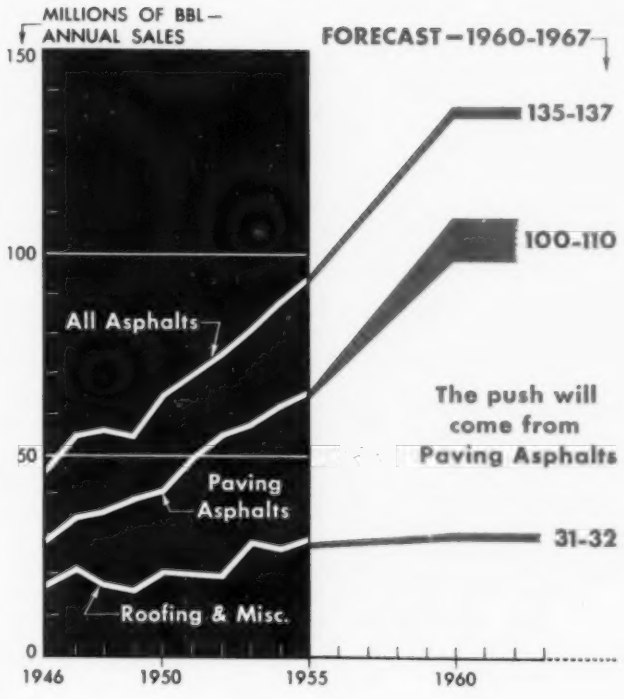
This is one of the new directions MIXCO research is taking. Our research department welcomes the opportunity to cooperate with you in any phase of your work leading to more efficient fluid mixing.

Lightnin® Mixers

MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 131-a Mt. Read Blvd., Rochester 11, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 10, Ont.



Surge Ahead For Asphalt

Road-building program catalyzes demand and poses some problems

By V. B. GUTHRIE, Associate Editor and W. A. BUSSARD, Assistant Editor

ASPHALT is fast becoming a big-time product in the petroleum processing industry today. The $50-billion, 10-year, highway construction program authorized by Congress and now getting underway has focussed the attention of many oil companies on this material. This is vastly different from the recent past, when asphalt—like heavy fuel oil—had been regarded as a bottom-of-the barrel product, its prices often reflecting its low position in the manufacturing scale.

Total US asphalt requirements, including road oil, will reach an estimated 135-137 million bbl annually during the next few years. This figures to a daily demand rate of about 370,000 bbl. Sales of asphalt will then have about tripled since World War II (see chart above).

The chart shows total sales for the period 1946-55, and expected demand to about 1962, during the anticipated peak of the road-building program. It is based on data from the Asphalt Institute, and various forecasts. Practically all asphalt used in this country comes from petroleum refineries. For example; in 1955, refineries produced 91.6 million bbl, and total sales were about 93.5 million bbl.

How were these estimates reached? The U.S. Bureau of Roads has estimated that the new road building program will push total annual asphalt demand to 56 million bbl by 1960 and hold it at that level through 1967.

And this is for construction only. Past practice has been to rate the use of asphalt in highway maintenance and re-surfacing about equal to its use in new construction. This means, according to one authority, that asphalt for road maintenance will add 50 million bbl/yr to the needs for new construction during the peak of the building program. Use of asphalt for roofing and miscellaneous industrial purposes is expected to reach 31 million bbl/yr by 1962. The approximate total annual market would, therefore, be 137 million bbl.

Another estimate, by one large oil company, agrees fairly well with this figure, pegging total use in 1963 at 135.5 million bbl. However, the breakdown is slightly different in the oil company estimate. Their total for asphalt for new highway construction is 62.5 million bbl in 1963, and that for road maintenance is about 41 million bbl. This is based on the rate the company believes secondary roads—large users of asphalt for new construction—will be built in relation to big interstate highways. Roofing and other uses were estimated at about 32 million bbl.

What will this demand upsurge mean to the refiner?

1—He should have no trouble meeting the expected volume requirements.

2—He will have to make fewer specific grades of asphaltic materials for the road building program.

3—He will have to cope with a confusing number of inspection requirements of various types.

4—He stands to gain more than an increased asphalt business: the building program itself will boost sales of motor fuels and lubes both to the actual construction contractors and to the ultimate highway users. *(Continued on next page)*

Petroleum Asphalt Requirements, 1957-69

For New Road Building Program—Not Including Maintenance
(Data from U. S. Bureau of Public Roads)
Million bbl

Year	Asphalt & Road Oils	Year	Asphalt & Road Oils
1957	48.02	1964	55.99
1958	52.2	1965	55.99
1959	54.45	1966	55.99
1960	55.99	1967	55.99
1961	55.99	1968	51.37
1962	55.99	1969	48.24
1963	55.99	Totals 1957-69	702.20

Domestic Sales of Petroleum Asphalts by Grades, and Road Oils, for Paving

(Data from U. S. Bureau of Mines)
Million bbl

Product	1955	1954	1953
Asphalt Cements	31.88	29.56	26.10
Cut-back Asphalts	21.90	20.82	20.29
Emulsified Asphalts	4.59	4.45	3.98
Total Asphalts	58.37	54.83	50.37
Road Oils	8.03	7.40	7.32
Total	66.40	62.23	57.69

5—He faces considerable competition from suppliers of paving materials other than asphalt, notably concrete.

Capacity Is Available

U. S. refineries now have an asphalt and road oil capacity of 380,000 to 400,000 b/d according to the Bureau of Mines. As stated earlier, the 135-137 million bbl/yr expected future demand averages about 370,000 b/d, thus no expansion in facilities would be needed. A further factor is that increased output can be achieved by converting more pipestill bottoms to asphalt and by processing crude oils with higher natural asphalt content.

A total of 70 refineries out of the 318 listed for the U. S. by the Mines Bureau are producing asphalt. And, in 14 of these plants, asphalt is the principal product. In addition, almost all complete refineries either make asphalt or can produce it without changing their process facilities.

Asphalt plants are scattered among 37 states. California has the largest capacity, about 60,000 b/d. Texas is second with nearly 30,000 b/d, and Illinois is third with about 25,000 b/d. New Jersey has 24,000 b/d of capacity, and Ohio, Indiana, and Kansas each have around 20,000 b/d.

Fewer Grades Will Meet the Needs

Reducing the number of different grades of asphaltic materials called for in the road program will simplify the refiner's problem in supplying these materials.

Such a trend is reported under way. Some grades used in small volume could be eliminated entirely, it is said. At present, 31 grades of asphaltic materials are recognized in specifications of the Asphalt Institute, the association of petroleum refiners who make these materials. These include nine grades of asphalt cements, 18 grades of cut-backs, and four of emulsified asphalts. (See tables and text on p. 43.

Pointing out the progress already made in cutting down the number of grades of asphalt specified for highway construction, the Institute cited these facts: In the 1920's there were 102 grades of asphalt cement. Today there are nine. There were over 100 grades of cut-back asphalt. Today there are 18. Oil companies believe that greater attention given by road contractors to procedures—grading, drainage, foundation, and pavement base—would make it possible for only four or five grades to fill all needs. They say also that the number of grades of cut-back could be further reduced.

Inspections are Confusing

Burdensome inspection procedures —and the lack of reciprocal inspection approvals between states—hamper the refiners in supplying asphalt for highway construction.

Take a look at today's situations.

1—The manuals issued by individual states covering requirements for suppliers and contractors in their road building programs include asphalts along with other materials under procedures for inspection, shipping, and handling. Because methods for inspecting asphalts are not published separately, state highway dept. engineers set up their own procedures to meet current conditions. These inspections are made by the engineers or their authorized agents, and the methods vary widely in different states.

2—Some states send their own inspectors to the refinery to check material before shipment. Other states require the oil company to send a sample from each tank car to the state laboratory, and approval must be received before the material can be used.

3—Some states inspect both at the refinery and in the laboratory.

4—In other states, tank car shipments must be approved and the car sealed, even though the tank car was loaded with material from a storage tank full of approved material. Yet, in these same states, shipments can be made in contractors' trucks from the same storage tank without approval.

5—In some states, the inspection agents have limited knowledge and training for their work, so they depend upon refinery personnel to do the actual testing.

6—A few states require the refiner to certify to the highway department for each tank car shipped, and they send inspectors occasionally to the refinery itself. Or, a state inspector remains at the refinery while the material is being made and shipped to the road contractor.

7—Some states require that an inspected and approved storage tank at the refinery be sealed at the inlet valve, and that no further new material be added except as the tank is checked again and re-approved. This forces the refiner to store material of the same specification in a separate tank for transfer later to the shipping tank.

8—When tank car samples have to be sent to the state laboratory for testing and approval, delays in some cases force the refiner to hold the tank car either at his own plant or

How to Make More Money on Asphalt

For an opinion on what refiners should be doing to improve their asphalt return, read "Is Asphalt Losing by Default?"—this issue, pg. 166. It outlines three areas where state highway department requirement could be simplified—to everyone's benefit.

at destination waiting for the tardy approval.

9—In the eastern states particularly, refiners ship asphalt from one plant into three or four states. Here, the inspection problems are compounded. This is especially true if one of the states has its own specifications differing in perhaps some nonessential characteristic from those of the Asphalt Institute or the American Society for Testing Materials (accepted in most states). In some cases, the outside receiving states send their own inspectors to the refinery, and these agents duplicate the work of the inspector in the state of origin.

The state authorities recognize their inspection systems are too involved and complex generally. They say this is required, however, because: 1) the asphalt materials are not ultimately consumed in the form in which they were shipped from the refinery, as is true with gasoline or heating oils, and 2) the materials are not used by the state agency but rather by privately-owned road contracting companies.

Oil companies say that if the states would accept specification material approved in the state of origin without further inspection—as just one example of an improved situation—savings could be realized by the state highway departments and delays spared the oil companies. They maintain also that inspection and handling procedures should be uniform throughout all states, because asphalts for highway use are limited in number of grades and are manufactured and sold on a nation-wide basis.

Asphalt Business Only Part of the Picture

The petroleum industry's stake in the $50 million highway construction is larger than the expanded volume of asphalt business refiners will get.

For example, products other than asphalt to be used in the highway program will average more than 25 million bbl/yr from 1960 to 1967, according to estimates by the Bureau of Public Roads. These include gasoline, diesel fuel, lubricating oils and greases used by road contractors and others participating in the program.

Of greater importance, direct benefits will accrue to all oil companies in the larger sales of motor fuel and lubricants through the increased use of automotive vehicles on the expanded and improved highways.

But There Will Be Competition

The asphalt business resulting from the highway program will not be handed on a silver platter to the oil companies without effort on their part. The Portland Cement Association and the contractors and state highway officials favoring concrete roads are already promoting and lobbying for the use of cement.

Cement proponents concede a higher initial cost, which is not too great a hurdle in view of the billions of dollars that will be available, but they also claim lower year-by-year maintenance costs.

Oil companies will have to promote vigorously—both on a local scale and nation-wide—the advantages of asphalt for road paving and in maintenance, if they are to secure their full share of the business.

For Better Asphalts . . .

Try Continuous, Automatic Blending

TECHNOLOGICAL changes in asphalt manufacturing and handling have been slow, partly because of asphalt's status as a poor cousin byproduct, readily available only from certain crudes. But with its increased use for highway construction, many refiners are taking a second look at technological advances that make asphalt manufacturing more attractive. One of these is blending equipment that permits accurate blending and direct loading of asphalt cutbacks.

Automatic continuous blending offers a number of advantages for asphalt cutback production, some of which are not generally recognized.

A continuous asphalt blending unit will permit a supplier to:

- Expand his range of grades and throughput —by converting cutback storage to base stock storage.
- Reduce inspection of base stocks to routine sampling—similar to the handling of other petroleum products.
- Deliver the product to within closer limits of state or industrial specifications.
- Meet quickly requirements for varying road conditions.
- Lower capital investment costs for terminal facilities.

Advantages apply to the customer of blended asphalt as well as to the supplier. Contractors, state highway departments and industrial users can obtain a more uniform product and in greater variety. The customer should also realize, in a lower price, the supplier's more efficient use of storage facilities.

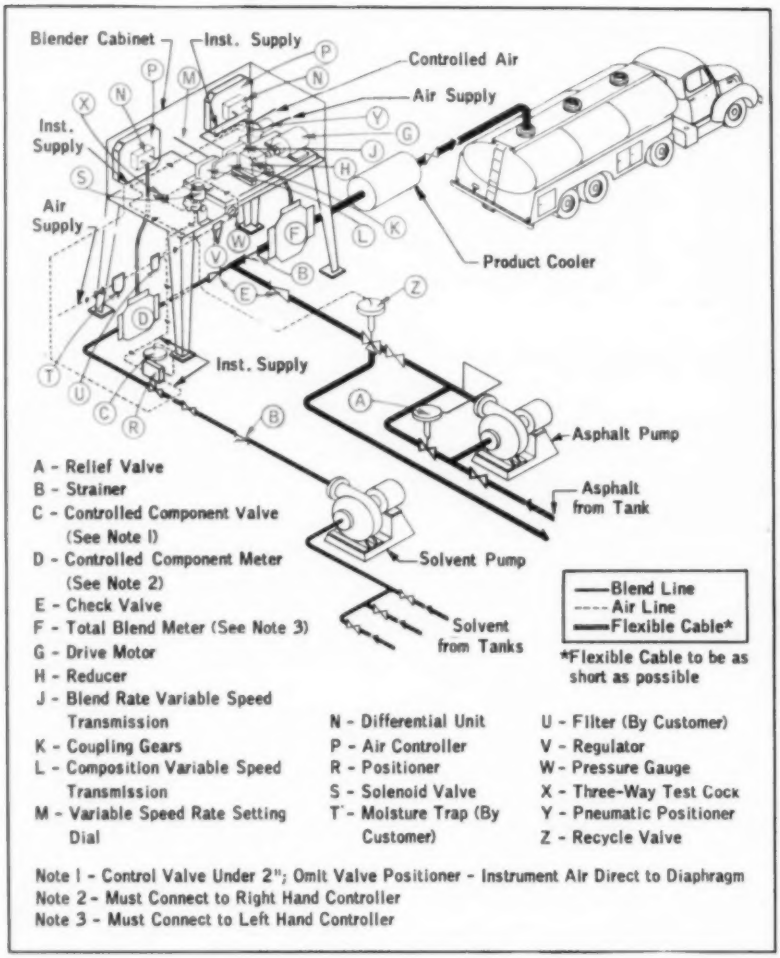
But the fly in the ointment seems to be required state inspections of asphalts before they are approved for road work. Continuous blenders, which permit direct blending-loading to a tank truck, don't seem to fit into present state inspection requirements. Because these inspection systems require holding both the blended asphalt cutbacks and the base stock for state analysis, the incentive for continuous blending is lacking—although it is attractive for supplying industrial accounts that don't require state inspection.

Some refiners have already installed continuous blending units for asphalt cutback, but mostly for their own convenience. These units handle up to 600 gpm, and can be designed to blend as much as 2000 gpm or more of either two or three components.

A continuous asphalt blender is no different from many gasoline or oil blenders now being used, except it is simpler. Normally only two components are blended—the base stock and the solvent altho 3-component units are available. A typical installation (see drawing) shows that no storage facilities are required between the component supplies and the waiting tank truck. The only operating unit is the continuous blender.

Base stock (asphalt) is fed directly from the storage tank through positive displacement meters and a cooler to the loading rack, accurately blending with the solvent on the way. The operator at the fill nozzle controls the filling rate without need for readjusting the blend. The blender always maintains the correct ratio of base stock and solvent over the full flow range of the pumps. This is because the actual rate of asphalt cutback is paced through action of the final blend meter. Any change in the total flow controls, through a mechanical linkage, the ratio of solvent admitted to the blend. As the operator throttles back, or opens up his nozzle, the total blend and the ratio of solvent-to-asphalt remains constant.

This type of continuous blender


Blender Cabinet
Inst. Supply
Controlled Air
Air Supply
Inst. Supply
Air Supply
Product Cooler
Inst. Supply
Asphalt Pump
Asphalt from Tank
Solvent Pump
Solvent from Tanks
Blend Line
Air Line
Flexible Cable*
*Flexible Cable to be as short as possible
A - Relief Valve
B - Strainer
C - Controlled Component Valve (See Note 1)
D - Controlled Component Meter (See Note 2)
E - Check Valve
F - Total Blend Meter (See Note 3)
G - Drive Motor
H - Reducer
J - Blend Rate Variable Speed Transmission
K - Coupling Gears
L - Composition Variable Speed Transmission
M - Variable Speed Rate Setting Dial
N - Differential Unit
P - Air Controller
R - Positioner
S - Solenoid Valve
T - Moisture Trap (By Customer)
U - Filter (By Customer)
V - Regulator
W - Pressure Gauge
X - Three-Way Test Cock
Y - Pneumatic Positioner
Z - Recycle Valve
Note 1 - Control Valve Under 2"; Omit Valve Positioner - Instrument Air Direct to Diaphragm
Note 2 - Must Connect to Right Hand Controller
Note 3 - Must Connect to Left Hand Controller

How Blending System Operates

A synchronous motor (G) drives a speed reducer and right angle drive (H). Its output is delivered to the *blend rate* variable speed transmission (J) and, through coupling gears, to *composition* variable speed transmission (L). A manual setting (M) specifies the percentage of solvent. Output speed from (L) is delivered to one side of a geared differential unit (N), which drives one side of a mechanical gear. The opposing gear is driven through cables from meter (D).

A spider, or differential gear, rides these two opposing gears. Any deviation of the metered rate from the master rate will move the differential gear around the periphery of the differential system. This differential rotates about a central shaft connected to air controller (P) and control valve and positioner (C & R). This will then increase or decrease flow through the meter (D) and bring the metered speed in line with computer speed.

As the operator throttles the nozzle, total blend meter (F) slows down and delivers to one side of the differential unit (N) a new report on actual flow of blended product. This is matched by an opposing gear driven from the master motor source and the *blend rate* variable speed transmission (J) output. A pneumatic positioner (Y) receives the air controller signal. As less blended product is called for, the input speed to the computer or master drive source is decreased, maintaining a constant ratio of asphalt and solvent.

has a "fail-safe" feature that automatically shuts down the blender and shows an "off" light when something goes wrong. Failure of electric power or air supply will also shutdown the blender.

Variations on this arrangement can readily be made to provide an additional solvent (one asphalt and two solvents blended simultaneously) or additives for imparting special properties to the cutback.

Because this blending system uses a feedback principle that continually senses, compares and adjusts, the blending is accurate to within the accuracy of the meters. For positive displacement meters this figure is usually ±½%.

How to insure specifications are met: Certain features must be added to the system insure a continuous check on end-product specifications. If the tank sampling method is to be supplemented, sufficient sampling and analytical devices must be provided for adequate control and accounting.

Instead of making the cutback tests on the blended asphalt, it is just as simple to check the base stock for penetration, ductility and carbon tetrachloride solubility. Once tested, the base stock can then be sealed off for running to the blending operation. In the same way, the solvents can also be sampled and sealed off for blending.

Viscosity of the blended asphalt can be charted continuously by one of several viscosimeters now commercially avaialble. Just as flow, temperature and pressure conditions are continuously charted (and accepted) in the operation of today's refinery, so an uninterrupted record of the viscosity of each delivery could be maintained. It could then be turned over to the state or local department responsible for delivery acceptance, and would show both the supplier and the customer any off-spec condition.

Percentage of distillation presents no problem either. Each of the meters can be equipped with a ticket printer. As with heating oil deliveries, each delivery to tank car or truck would have the meter readings printed at the start and finish. Cards could be printed for trucker, supplier and inspector alike. Then a simple computation will readily indicate percent of solvent in the blend.

Equipment different from the unit pictured can be used for blending two cutback ingredients, although they will not have the accuracy and flexibility of the positive displacement

method. By means of differential meters (rotameters) in both streams, flow signals can be fed to a preset ratio comparator that maintains a percentage flow of secondary to primary component.

This flow ratio method differs from the previous method in a number of ways. Accuracy with differential devices applicable for this use varies between ±1 and 3% over approximately a 3:1 range. On the other hand, the positive displacement method has an accuracy of ±½% over a 5:1 range. Deviation from set conditions requires correction in both systems, but in the flow ratio method, the over or under feed causing the upset goes uncorrected.

The positive displacement-geared differential system (shown in drawing) makes up the over or under feed before it returns to the set point. In this way it can be said to have a memory. Because differential meters are instantaneous, integration of flow is an added function of metering that is basically a rate measurement. The positive displacement meter system, however, measures volume directly and integrates it continuously. This characteristic permits the inclusion of previously mentioned recording devices that will insure positive accounting of measured variables to meet specifications.

How to get continuous blending approved: Naturally, the various highway departments and associated groups cannot accept these recommended changes overnight. There must be some period of testing and accumulation of data. Possibly some refiners, in cooperation with a number of state government departments, could install continuous in-line blending equipment and establish a test period. During, and at the end of, the test period the results could be analyzed by both groups and tentative approval of the method be justified.

Such a cooperative test period would permit accumulation of data and still not interfere with normal deliveries to meet private and local cutback needs. Although the initial cost of the equipment would be born by the supplier, he would benefit by more efficient blending. Blends would be correct on the first run; foaming and loss of light ends from agitation would be eliminated; and the time between receipt of an order and shipment would be reduced. Meanwhile the data to prove the acceptability of this method for state approval would be accumulated under the eye of the existing state inspection agency.

31 Asphalt Grades And their Specifications

OF THE present number of 31 grades of asphaltic material specified by the Asphalt Institute (see tables), 9 are asphaltic cement, 18 are cut-back asphalts and 4 are emulsified asphalts. ASTM methods of test are called for in determining grade characteristics.

Cements are the semi-solid to solid segments of the asphalt family, and in road building are used principally in the "hot-mix" pavements. The 9 grades are classified by the penetration test, a measure of the consistency of the material. In this test, a weighted needle bears on the surface of a dish of asphalt for a set period at 77°F. The penetration of the needle is measured in units of 1/10 ml. The penetration standard varies for the 9 grades from 30-40 to 200-300. Another important characteristic is ductility. Cements possessing ductility are normally more cementitious and more suitable for paving mixes. The flash point of a cement is primarily important to the user, because it tells to what degree the material can be safely heated.

Asphalt cut-backs are in three classi-

Specifications for Asphalt Materials

CEMENTS

Characteristics	A.S.T.M. Method	Paving Cements		
General Requirements		The asphalt shall be prepared by the refining of petroleum. It shall be uniform in character and shall not foam when heated at 350° F.		
Flash Point (Cleveland Open Cup), °F.	D92	450+	425+	350+
		Penetration Grades		
Penetration, 77° F., 100 g., 5 sec.	D5	40-50 50-60 60-70 70-85 85-100	100-120 120-150 150-200	200-300
Loss on Heating 325° F., 5 hrs., %	D6	1−	2−	2−
Penetration After Loss on Heating 77° F., 100 g., 5 sec., % of Original	D5	70+	70+	60+
Ductility:				
At 77° F., cms.	D113	100+	60+	
At 60° F., cms.	D113			60+
Solubility in Carbon Tetrachloride, %	D4*	99.5+	99.5+	99.5+

*Except that carbon tetrachloride is used instead of carbon disulphide as solvent, Method No. 1.

RAPID-CURING LIQUID ASPHALTIC MATERIALS

Specification Designation		RC-0	RC-1	RC-2	RC-3	RC-4	RC-5
General Requirements	A.S.T.M. Method	The material shall be free from water					
Flash Point (Open Tag.), ° F.	*			80+	80+	80+	80+
Furol Viscosity at 70° F. sec.	D88	75-100					
Furol Viscosity at 122° F., sec.	D88		75-150				
Furol Viscosity at 140° F. sec.	D88			100-200	250-500		
Furol Viscosity at 180° F. sec.	D88					125-250	300-600
Distillation:							
Distillate (per cent of total distillate to 680° F.)							
To 374° F.	D402	15+	10+				
To 437° F.	D402	55+	50+	40+	25+	8+	
To 500° F.	D402	75+	70+	65+	55+	40+	25+
To 600° F.	D402	90+	88+	87+	83+	80+	70+
Residue from distillation to 680° F. Volume per cent by difference	D402	50+	60+	67+	73+	78+	82+
Tests on Residue from Distillation							
Penetration 77° F., 100 g., 5 sec.	D5	80-120	80-120	80-120	80-120	80-120	80-120
Ductility 77° F.	D113	100+	100+	100+	100+	100+	100+
Solubility in Carbon Tetrachloride, %	D4**	99.5+	99.5+	99.5+	99.5+	99.5+	99.5+

*A.A.S.H.O. Method T79-42.
**Except that carbon tetrachloride is used instead of carbon disulphide as solvent, Method No. 1.

Specifications for Asphalt Materials (continued)

MEDIUM-CURING LIQUID ASPHALTIC MATERIALS

Specification Designation		MC-0	MC-1	MC-2	MC-3	MC-4	MC-5
General Requirements	**Method A.S.T.M.**	The material shall be free from water.					
Flash Point (Open Tag.), ° F.	*	100+	100+	150+	150+	150+	150+
Furol Viscosity at 77° F., sec.	D88	75-150					
Furol Viscosity at 123° F., sec.			75-150				
Furol Viscosity at 140° F., sec.				100-200	250-500		
Furol Viscosity at 180° F., sec.						125-250	300-600
Distillation:							
Distillate (per cent of total distillate to 680° F.)							
To 437° F.		25—	20—	10—	5—	0	0
To 500° F.		40-70	25-65	15-55	5-40	30—	20—
To 600° F.	D402	75-93	70-90	60-87	55-85	40-80	20-75
Residue from distillation to 680° F. Volume per cent, by difference		50+	60+	67+	73+	78+	82+
Tests on Residue from Distillation							
Penetration 77° F., 100 g., 5 sec.	D5	120-300	120-300	120-300	120-300	120-300	120-300
Ductility 77° F.**	D113	100+	100+	100+	100+	100+	100+
Solubility in Carbon Tetrachloride, %	D4***	99.5+	99.5+	99.5+	99.5+	99.5+	99.5+

*A.A.S.H.O. Method T79-42.
**If penetration of residue is more than 200 and its ductility at 77° F. is less than 100, the material will be acceptable if its ductility at 60° F. is 100+.
***Except that carbon tetrachloride is used instead of carbon disulphide as solvent, Method No. 1.

SLOW CURING LIQUID ASPHALTIC MATERIALS

Specification Designation		SC-0	SC-1	SC-2	SC-3	SC-4	SC-5
General Requirements	**A.S.T.M. Method**	The material shall be free from water					
Flash Point (Cleveland Open Cup), ° F.	D92	150+	150+	175+	200+	225+	250+
Furol Viscosity at 77° F. sec.		75-150					
Furol Viscosity at 122° F. sec.	D88		75-150				
Furol Viscosity at 140° F. sec.				100-200	250-500		
Furol Viscosity at 180 F. sec.						125-250	300-600
Water, %	D95	0.5—	0.5—				
Distillation:							
Total Distillate at 680° F.	D402	15-40	10-30	5-25	2-15	10—	5—
Float Test on Residue at 122° F., sec.	D139	15-100	20-100	25-100	50-125	60-150	75-200
Asphalt Residue of 100 Penetration, %	D243	40+	50+	60+	70+	75+	80+
Ductility Asphalt Residue at 77° F.	D113	100+	100+	100+	100+	100+	100+
Solubility in Carbon Tetrachloride, %	D4*	99.5+	9.5+	99.5+	99.5+	99.5+	99.5+

*Except that carbon tetrachloride is used of carbon disulphide as solvent. Method No. 1. If the material fails to meet the requirement for solubility it will be acceptable if its solubility in carbon disulphide is 99%+, and proportion of bitumen soluble in carbon tetrachloride is 99.65%+.

EMULSIFIED ASPHALTS

Specification Designation	A.S.T.M. Method	Rapid Setting RS-1	Rapid Setting RS-2	Medium Setting MS-2	Slow Setting SS-1
Tests on Emulsion:					
Viscosity, Saybolt Furol at 77° F., sec.		20-100		100+	20-100
at 122° F., sec.			75-400		
Residue by distillation, %		57-62	62-69	62-69	57-62
Settlement, 5 days, %	D224	3—	3—	3—	3—
Demulsibility:					
35 ml. of 0.02 **N** $CaCl_2$, %		60+	50+		
50 ml. of 0.10 **N** $CaCl_2$, %				30—	
Sieve Test (Ret. on #20), %		0.10—	0.10—	0.10—	0.10—
Cement Mixing Test, %					2.0—
Tests on Residue:					
Penetration at 77° F., 100 g., 5 sec.	D5	100-200	100-200	100-200	100-200
Soluble in CS_2, %	D4	97.5+	97.5+	97.5+	97.5+
Ductility at 77° F., cm.	D113	40+	40+	40+	40+

fications: rapid curing, medium curing, and slow curing. The last named are the refiners' road oils. The cut-backs are a blend of asphalt cements and volatile petroleum distillates, and are made at the refinery. The rapid curing type is prepared with a gasoline or naphtha with a high evaporation rate; the medium curing generally with kerosine. The slow curing type or road oils are usually a residual material from the fractional distillation of crude oils. The asphalt cut-backs are used in a wide variety of road building and resurfacing operations where the need is for materials of a more liquid consistency than the cements.

The 6 grades of each cut-back classification are rated by consistency, measured by the ASTM Saybolt Furol Viscosity test. Determination of flash point is usually required for these materials. The distillation test separates the two constitutents to determine the relative proportions of the asphalt cement and the diluent. The characteristics of the diluent are important to the paving engineer, because they govern the rate of evaporation and hence of "cure".

Emlsified asphalt, of which there are 4 grades, are finding increasing use in preparing the road base prior to applying the asphalt pavement surface, and for surface application on secondary roads. The material consists of minute globules of asphalt suspended in chemically-treated water. The emulsions are prepared in a high-speed mixing apparatus that emulsifies the asphalt into the water. The chemical used in treating the water is usually some type of caustic soap, clay, or other agent that assists in promoting the emulsification process and also controls some of the properties of the emulsion.

The grade of emulsified asphalt is determined basically by the standard Saybolt Furol Viscosity test. The distillation test determines the proportional amounts of asphalt and water, and provides an asphalt residue that may be subjected to further tests. The settlement test detects the tendency of the asphalt globules to settle during the storage of an emulsified asphalt.

Specifications for asphaltic materials have also been issued by the American Society for Testing Materials, under the jurisdiction of its Committee D-4 on Road and Paving Materials. The standards are for the same grades and the same essential characteristics as those of the Asphalt Institute, except that the ASTM has no specifications on the slow curing (road oil) type of cut-back asphalts.

Baton Rouge Gets Facelifting

And morale, safety and housekeeping improve

ESSO'S vacuum tower, pipe still and other units sparkle colorfully

OILMEN snapping color shots in the whopping (340,000 b/d capacity) Baton Rouge, La., refinery of Esso Standard Oil Co. now have a subject worth capturing in color. A rainbow is spreading over the plant, crowding out the usual, drab combinations of black, gray and aluminum. Green landscaping is springing up around processing units, and hard-surfaced streets are being restyled with curbs and drainage basins.

Already the country's largest refinery, the plant is now certainly one of the most eye-appealing.

"Face-lifting," Esso style, was started about four years ago when it was decided that a refinery could be attractive as well as functional. But the leap into a new field (for refinery men) was not a hasty move—color consultants were called in to recommend a planned program of re-decoration. After studying refinery needs, durability of paints, and possible color combinations, Esso settled on thirteen basic pastel colors that could be used in any combination.

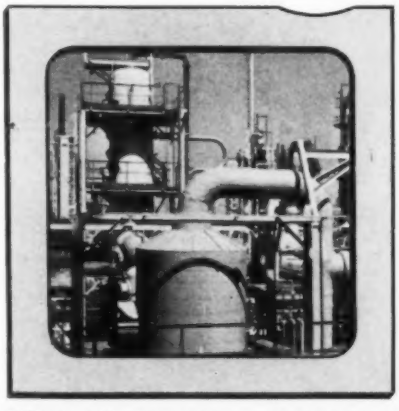
Existing facilities have been colored during routine maintenance painting and all construction since has followed the new color scheme. Today, four years after the program began, about 40% of the refinery has been converted to color. In two years, the change will be virtually complete. Approximately 150,000 gal of paint have been used to date.

Esso estimated that the cost of painting with color is just under 15% more than painting with conventional black and aluminum, because colors limit the amount of spray painting that can be used. Material costs and durability of the new paints are about the same as other paints and no additional maintenance costs are expected.

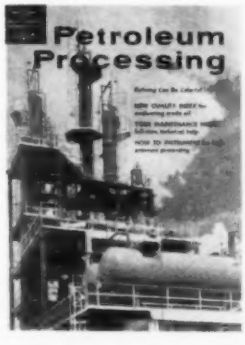
Landscaping and road surfacing is being done along with new construction. About 22 acres of refinery property, not including firebanks, have been sodded with grass and some 6000 trees and shrubs have been planted.

Most obvious asset of the new look, of course, is the boost it gives employe morale. In addition, repainting in color has improved housekeeping practices tremendously.

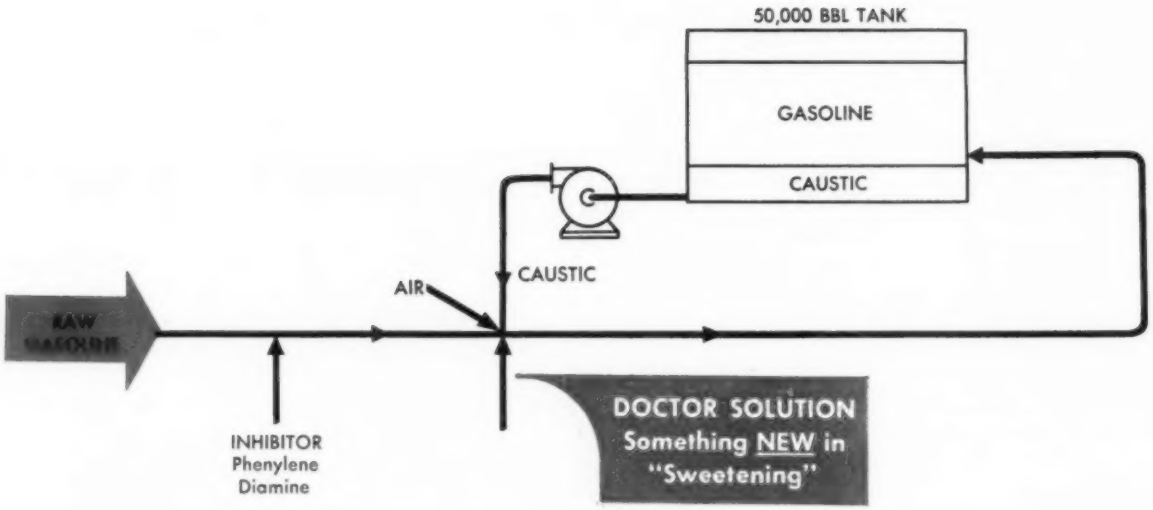
Although safety is a hard thing to tie onto such a program, improved visibility, standout colors, and less monotonous surroundings unquestionably make safer working conditions.



LIGHT ENDS unit (left), chemical products tanks (right) also gleam



This Month's Cover shows Baton Rouge in full brilliance of color



Add Doctor Injection for . . .

Better Inhibitor Sweetening

By L. D. RAMPINO and M. J. GORHAM, Tidewater Oil Co., Associated, Calif.

THE SCHEMATIC above shows the commercial-scale operation of an improved inhibitor sweetening process for light cracked gasoline that has shown—both in the laboratory and full-scale—these four advantages:

1—Faster sweetening.

2—Lower peroxide content in the sweet naphtha.

3—Improved product quality.

4—Substantial savings realized through decreased usage of inhibitor and tetraethyl lead.

The new process is essentially as follows (see diagram above): Light catalytic gasoline is inhibited immediately after production (phenylene diamine type, 7.5 lb/1000 bbl). The gasoline is then contacted with a mixture of caustic, doctor solution, and air, and this mixture flows to a run-down tank. Caustic is withdrawn continuously from the bottom of the tank and recirculated. Certain features of the process are the subject of a recent patent.

In conventional inhibitor sweetening—on the other hand—no doctor solution is used. Sour gasoline is first inhibited with the phenylene diamine, and then contacted with air and caustic. After storage for a variable period of time, the gasoline loses the mercaptan odor and is sweet. The time of sweetening can be long or short, depending on the type of gasoline, the amount and type of mercaptans, and the way the process is conducted.

The big disadvantage to this technique is this: Peroxides are formed as sweetening takes place.[1] These peroxides lead to increased gum and lowered engine cleanliness. As a result, only certain types of gasoline can be sweetened satisfactorily by this process. In addition, the end point of the gasoline must be controlled to prevent excessive gum formation.

This article will present: 1) laboratory data, 2) commercial data, and 3) a proposed mechanism to explain the chemistry of the process.

Laboratory Procedure and Results

The light catalytic gasoline used in this work had a mercaptan sulfur range of 0.003 to 0.007 gm/100 cc; and a boiling range of about 110 to 285°F. Phenylene diamine inhibitor was injected into the gasoline immediately after production and before contact with air, at a rate of 7.5 lb/1000 bbl.

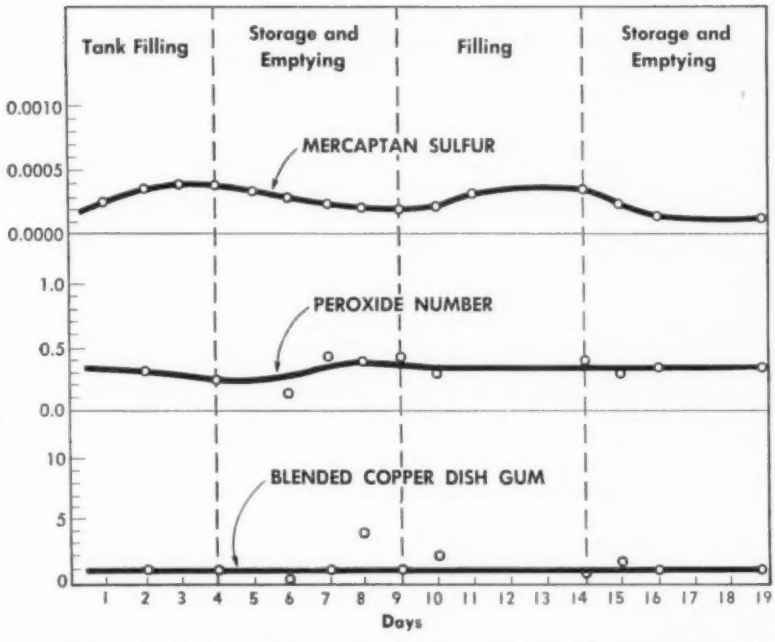
A quantity of 25 cc of 10° Bé caustic was placed in a brown-glass, one-qt. bottle, and 0.1 cc of doctor solution added. Then 500 cc of the inhibited light catalytic gasoline was added to the bottle, and the combined mixture was shaken vigorously by hand for about 10 seconds. The bottle was then capped with a slotted cork and the gasoline-caustic mixture allowed to stand without further agitation. From time to time, 25-cc samples of gasoline and 2-cc samples of caustic were pipetted from the bottle for various tests.

Mercaptan sulfur was determined potentiometrically by silver nitrate titration. Peroxide number was measured by Universal Oil Products Method H33-40, based on a method of Yule and Wilson.[2] Blended copper dish gum was measured on a blend containing 50 vol-% of the gasoline and 50 vol-% of a light aromatic solvent containing 55% aromatics and having a boiling range of 220 to 305° F. This blend shows a much higher

Table 1—How Doctor Solution Affects Sweetening of Light Catalytic Gasoline

(Mercaptan sulfur of raw gasoline: 0.0027 gm per 100)

	No Doctor solution in Caustic	Doctor solution in Caustic
After storage for 3 days:		
Modified Doctor Test	sour	sweet
Merc. of S. of gasoline	0.00035	0.00013
Merc. S. of caustic	0.020	0.004
After 4 days:		
Peroxide No.	0.58	0.29
ASTM gum	0.8	0.6
Blended Cu dish gum	16	5
After 10 days:		
Peroxide No.	0.45	0.11
Blended Cu dish gum	7	0



CHANGES in three variables over 19-day period during doctor-air-caustic sweetening of inhibited light catalytic gasoline

copper dish gum than the gasoline itself: it was used because it magnified differences in gasoline quality.

The doctor solution increased the speed of sweetening and lowered the peroxide content of the sweetened gasoline (see Table 1). Note the drop in mercaptan content of the gasoline after three days of storage, with and without doctor solution. It is also apparent that the mercaptans in the caustic layer also disappeared at a faster rate when doctor solution was present in the caustic.

In this experiment, the amount of doctor solution used corresponded to 5% of theoretical for reacting with all the mercaptans present originally in the gasoline.

The results in Table 1 show also that on continued standing, peroxides formed initially in the gasoline disappeared at a faster rate when doctor solution was present. Note in addition that the blended copper dish gum of sweet gasoline was lower in the presence of doctor solution: it is apparent that as peroxides were destroyed the copper dish gum value decreased.

A modified doctor test was developed for this test because the conventional technique proved unsuitable for gasoline containing peroxides. The conventional test requires two steps: sour gasoline and doctor solution are first shaken together to form lead mercaptides, then sulfur is added and the mixture is shaken again to convert lead mercaptide to lead sulfide. Absence of an orange discoloration at the interface between gasoline and doctor solution is supposed to indicate an extremely low mercaptan content.

Peroxides interfere with this test by destroying lead mercaptide. As a result, lead sulfide cannot form during the sulfur addition step. This means that a gasoline containing peroxide can give a sweet doctor test even though a considerable amount of mercaptans may be present.

To overcome this interference, the modified doctor test is made in one step: gasoline, doctor solution, and sulfur are shaken together all at one time. The lead mercaptides formed react immediately with the sulfur, and the peroxides do not really interfere.

For example, the modified doctor test obtains a sour reaction at a mercaptan sulfur content as low as 0.0002 gm/100 cc, even when the peroxide number of the gasoline is about 0.4. However, with the conventional doctor test, a gasoline with a peroxide number of 1 will give a sweet test at a mercaptan sulfur content about 0.0005 gm/100 cc. If peroxide content is high enough, even a gasoline with a bad odor will give a sweet test.

Commercial Operation

Line samples of the gasoline-caustic mixture were taken just ahead of entry into the tank (see schematic flow diagram), and laboratory sweetening experiments were run on these samples. Table 2 shows results of tests on the

Table 2—How Doctor Solution Affected Laboratory Sweetening of Line Samples of Gasoline-Caustic Mixture

(Merc. sulfur of raw gasoline: 0.0031 gm per 100 cc)

	Before Doc. Injection	After Doc. Injection
Tests on sweet gasol:		
Peroxide No.	1.0	0.08
Blended Cu dish gum	30	2

Table 3—How Laboratory Sweetening Affected Light Catalytic Gasoline in Absence and Presence of Refinery Caustic

(Merc. sulfur of raw gasoline: 0.0031 gm per 100 cc)

	Line Sample before entry into tank	After 2-day storage	
		Caustic absent	Doc.-Caustic present
Mercaptan sulfur	0.00094	....	....
Peroxide Number	0.08	0.67	0.08
Blended Cu dish gum	1	60	2
Modified Doctor Test	.....	sour	sweet

gasoline before and after startup of doctor injection. Laboratory sweetening was conducted in the presence of caustic as sampled.

It can be seen that the sweet gasoline has a much lower peroxide number and less copper dish gum after the doctor injection was started.

In the commercial experiment, the amount of doctor solution injected corresponded to 1% of the theoretical amount needed to react with the all mercaptans present originally in the gasoline. This compares to the 5% used in the laboratory experiment mentioned above.

The effect of sweetening in the absence of caustic was also studied. For this, a line sample of the mixture taken ahead of tank entry was allowed to settle and a portion of the clear gasoline was stored in the absence of caustic. The remaining portion was allowed to sweeten in the presence of the caustic as sampled.

Table 3 compares the effect of conducting sweetening with and without caustic present. It is evident that the gasoline had a low peroxide number before it entered the storage tank. It is also evident that when the clear gasoline was allowed to sweeten in the absence of caustic, the peroxide number and copper dish value increased considerably.

These data suggest that once the gasoline-caustic mixture enters the rundown tank and separates into two phases, sweetening leads to lowered product quality. The implication is clear:

For optimum product quality, a gasoline must be kept in contact with the caustic-doctor-air mixture until sweetening is complete.

The data presented so far were for laboratory sweetening. In commercial practice, however, the sweetening is completed in the large tank. To simplify this operation two tanks were used alternately. The mixture of gasoline and caustic was pumped continuously into one 55,000-bbl tank until it was full: the mixture was then diverted to a second 55,000-bbl tank while the first was being emptied of sweet gasoline.

Results of this operation are shown in Fig. 1. The data were obtained over almost a three-week period on samples of gasoline taken from both tanks during filling and emptying. The curves show that the speed of sweetening was very rapid—tank samples were usually doctor-sweet even though sour gasoline was entering the tank continuously at the time of sampling. In those tests where samples were not doctor-sweet (usually on the last day of filling), storage for one day (with no sour gasoline pumped into the tank) was sufficient to produce a sweet gasoline.

More recent data show the gasoline in the tanks is always sweet—mercaptan sulfur contents are usually less than 0.0001 gm/100 cc. This means that less storage space is required for sweetening.

Even more significant, however, is this fact: the gasoline, *after sweetening*, has a very low peroxide number and little copper dish gum. Thus, doctor injection achieves what had previously been impossible when conventional inhibitor sweetening was used.

In fact, before any improvements had been made in sweetening—that is, when we depended upon dissolved oxygen and carry-over caustic in the gasoline for sweetening—peroxide numbers of 1.5 and 2.0 were the rule, and copper dish gums of 100 to 200 were not unusual. In addition, sweetening time was sometitmes as much as two weeks. End point of the gasoline had to be lower because of lower quality.

Effect of raising gasoline end point. After it was found that sweet gasolines of low peroxide number and copper dish gum could be obtained in the refinery, the end point of the gasoline was increased. This led to higher peroxide number and copper dish gum. However, when a line sample of doctor - air - caustic - gasoline mixture (containing identical gasolines) was allowed to sweeten *in the laboratory*, peroxide number and gum value after sweetening were no higher than that of lower end point gasoline. This means that the way the sweetening process was conducted was more important than end point in determining product quality.

The difference between refinery and lab sweetening is this: In the refinery, a column of gasoline as high as 40 ft is stored over caustic: in the laboratory the height of the gasoline layer above the caustic was only 5 inches. As a result, a better contact between gasoline and caustic is achieved during laboratory sweetening.

Improvements are being made in refinery operation from time to time to obtain sweet gasoline of still higher end point but without sacrifice of excellent quality.

Inhibitor disappearance. A small amount of data was obtained on the change of inhibitor content of tank samples of gasoline after sweetening. They show in some cases hardly any reduction in inhibitor concentration after sweetening and—sometimes—a loss of a few lb/1000 bbl of gasoline.

Reduced inhibitor costs. As mentioned above, conventional inhibitor sweetening leads to high peroxide numbers and high copper dish gum. For refiners who have a copper dish gum specification on their finished gasoline and who require extra inhibitor to reduce this gum, the improved process can lead to substantial savings through the reduction in inhibitor usage.

Table 4—The Lower the Peroxide Number, the Lower the Tetraethyl Lead Requirements

(Premium blends containing light cat gasol. of different peroxide content)

	Blend A	Blend B
Peroxide Numbers:		
50% reformate	0.15	0.15
30% light cat gasoline	1.30	0.33
20% natural gasoline	0.00	0.00
Final blend	0.49	0.16
Octane Numbers:		
Res. Method, clear	89.0	89.5
Res. Method, + 3 cc TEL	96.8	97.5
Motor method, clear	80.2	80.3
Motor method, + 3 cc TEL	87.6	88.0
TEL (cc/gal) needed to make:		
94.5 Res. Octane	1.49	1.23
96.0 Res. Octane	2.34	1.88

Blend B requires 0.46 cc/gal less of TEL to make 96 RON. This represents a savings in TEL of $41,600 per million gallons of blend.

Reduced TEL usage. It has been found that the octane number of premium gasolines containing reformates is lowered by the presence of peroxides. Table 4 shows octane numbers of a premium gasoline containing light catalytic gasoline of different peroxide contents.

The blends tested contained 50% reformate, 30% light catalytic gasoline, and 20% of natural gasoline. In one case (Blend *A*), the light catalytic gasoline had a peroxide number of 1.3 (after sweetening over caustic containing no doctor solution); in the other case (Blend *B*), the light catalytic gasoline had a peroxide number of 0.33 (sweetening over caustic containing a small amount of doctor solution). The research octane numbers of Blend *B* were 0.5 to 0.7 units higher than Blend *A*.

The amount of tetraethyl lead required to meet a 94.5 research octane specification was 1.49 cc for Blend *A* and 1.23 cc for Blend *B*, a difference of 0.26 cc/gal. This difference increases as the octane number is raised, amounting to 0.46 cc at 96 RON. At 96 RON, the savings in TEL usage amount to $41,600 for every million gallons of the gasoline blend shown in Table 4.

Chemistry of the Process

Three facts need to be explained in understanding the chemistry of this process:

1—Lead, bismuth, and thallium were the only metals effective for producing a sweet gasoline of very low peroxide content. Lead is effective in either the plumbous or plumbic form. A number of other metals were also tried.

2—Speed of sweetening was faster when the three metals were present in the caustic.

3—The amount of lead required is less than 5% of stoichiometric for reacting with the amount of mercaptans that were sweetened.

The explanation of point 1 is based on two properties lead, bismuth, and thallium possess in common: 1) they form mercaptides easily, and 2) their mercaptides are easily oxidized.

For the second and third points—the catalytic action of these metals—it is postulated that lead is alternately oxidized and reduced. In the oxidation step, a gasoline peroxide or atmospheric oxygen oxidizes lead mercaptide to a solid peroxide of lead mercaptide, $Pb(SR)_2O_x$, a type of compound that has been described in the literature.[3] This peroxide oxidizes mercaptans to disulfides: the lead compound formed in this reaction then reacts with more peroxides.

This means that lead mercaptide is a carrier of oxygen, and in this way serves as a catalyst for the peroxides-mercaptans reaction.

The more rapid rate of sweetening observed with the metals is attributed to the ability of their mercaptides to make peroxidic oxygen or atmospheric oxygen available for reacting with mercaptans. When the metals in their higher state of oxidation are used, metal mercaptides are also formed and the mechanism of action is believed to take the same course.

Some data substantiating the hypothesis include:

Ease of mercaptide formation was indicated by the immediate formation of yellow precipitates when mercaptan was added to a solution of sodium plumbite or sodium plumbate. Precipitates, believed to be mercaptides, were also obtained immediately when caustic containing bismuth trioxide or tetroxide was added to refinery caustic containing mercaptans (bismuth mercaptides have been reported in the literature[4]). A solution of thallous chloride in caustic also gave an immediate yellow crystalline precipitate when shaken with sour gasoline.

The fact that cadmium, which formed a mercaptide easily, was not effective in lowering peroxide content indicated that the mercaptide of the metal had to possess some additional property to make it effective. This added requirement is that the mercaptide should be easily oxidized.

Ease of oxidation of metal mercaptides. In the cadmium experiments it was observed that the cadmium mercaptide formed in the caustic did not change its appearance on standing in the presence of gasoline containing peroxides. This stability of cadmium mercaptide toward oxidation has also been reported in the patent literature.[5] It is believed to be the explanation for the ineffectiveness of cadium.

With lead and thallium, however, dark precipitates were formed from the yellow mercaptides. Evidence that lead mercaptide forms a peroxide that can oxidize mercaptans was obtained in our laboratory by Dr. R. H. Decker. Solutions of lead mercaptide in benzene formed precipitates when exposed to air. When these precipitates were stored in an atmosphere of nitrogen with a benzene solution of mercaptan, all the mercaptan was oxidized.

References

(1) Rampino, L. D., and Gorham, M. J.; PETROLEUM PROCESSING, Vol. 10, No. 9, August, 1955, pp. 1146-1149.

(2) Yule, J. A. C. and Wilson, Jr., C. P.; *Ind. Eng. Chem.*, Vol. 23, p. 1254 (1931).

(3) Ott, E., and Reid, E. E.; *Ind. Eng. Chem.*, Vol. 22, p. 882 (1930).

(4) *Chem. Abstracts*, Vol. 40, p. 6407 (1946).

(5) U.S. Patent 2,581,493.

Meet the Authors

Dr. Rampino

Mr. Gorham

Louis D. Rampino is senior research chemist at Tidewater Oil Co.'s Avon refinery, Associated, Calif. He has been concerned with gasoline problems since he joined the company in 1946. Dr. Rampino received his Ph.D. at Fordham University in 1941. He then became associated with the Manhattan District Project at the facilities at Princeton University.

In 1943, he joined Shell Development Co. at Emeryville, Calif., as a group leader on studies of cracking catalysts. He is a member of the American Chemical Society, American Institute of Chemists, and Sigma Xi.

Milton J. Gorham is also a senior research chemist for Tidewater at the Avon refinery. And, as Dr. Rampino did, he joined the company in 1946. Mr. Gorham received his B.S. in chemistry in 1943 from the University of Minnesota, then worked briefly for Sharples Chemical Co., and spent two years in the U. S. Navy before coming to Tidewater. He is a member of the American Chemical Society.

Dr. Rampino and Mr. Gorham are previous contributors to PETROLEUM PROCESSING. They authored the article: "Chemistry of Inhibitor Sweetening," published August, 1955, pp. 1146-1149.

"THE PICKS OF '56"

What's New Items Rated by

Equipment

Easily Applied Pipe Markers

. . . snap over the outside of bare pipe or insulation, and are held in place by cementing the overlapping edges of the plastic label. Printed on color-coded background, the words identifying the pipe line are protected by a sheet of vinylite molded to the contour of the pipe. The markers come in rigid sheets up to 25 x 21 in., and clamp around pipe ranging in diameter from ½ to 30 in. They are also available with holes cut out for installation around valves. Wilmington Plastics Co., 810 S. Heald St., Wilmington 1, Del.

Circle No. **1** *on Reply Card*

High Temperature Caulking

. . . up to 2300°F—with a ceramic rope made of an aluminum-silicate fiber. When combined with 15% of a carrier-type fiber, the long staple of the "Fiberfrax" provides a resilient and lightweight rope. The material is chemically inert and unaffected by most furnace atmospheres, including hydrogen. It can also be used for insulator wrapping, high temperature gaskets and seals, and as a high temperature joint packing. The ceramic rope weighs two-thirds of asbestos rope. Carborundum Co., Niagara Falls, N. Y.

Circle No. **2** *on Reply Card*

Platforming Catalysts

. . . are tailored for producing gasolines of 98 leaded octane number and higher. These improved catalysts, UOP Types R-7 and R-8, are of low density and high activity. Their shape is spherical but smaller in size than the older line of catalysts. They are reported to give increased yields in the production of high octane number gasolines, with more hydrogen and less carbon. Type R-8 is available, under special arrangement, with a higher platinum content. Universal Oil Products Co., Des Plaines, Ill.

Circle No. **3** *on Reply Card*

Surface Thermometer

. . . reads to 1,000°F. Within 60 seconds of placing the stainless steel instrument on the surface to be checked, it will read the temperature accurately to within ±2%. It can be used on all hot surfaces such as heavy sheet metal, boilers, and large steam pipes. The thermometer will also read ambient temperatures in enclosed spaces and in non-corrosive liquids and gases. The diameter is only 1¾ in. and the weight is ⅓ oz. Pacific Transducer Corp., 11836 W. Pico Blvd., Los Angeles 64, Calif.

Circle No. **4** *on Reply Card*

Tailor-Made Chromatograph

. . . analyzes the proportion of refinery gases being upgraded in a process unit, either periodically or continuously. A steady flow of dry air propels samples of the gas through 20-ft columns packed with activated alumina. Emerging from the columns one after another, the components (mainly propane and propylene) move through a special detector. This consists of a small bed of activated carbon that heats up when the sample flows through it. Measuring the heating effect and transmitting electric signals to a remote recorder permits graphic analysis of the refinery gases. Esso Research and Engineering Co., 15 West 51st St., 19, N. Y.

Circle No. **5** *on Reply Card*

Abrasive Material Pump

. . . handles petroleum coke, ash, or slag and fly ash. For protection the pump has a small stream of water circulating continuously through clearance spaces between the rotating impeller and the stationary shell. This not only protects the shaft, stuffing box and suction seal from abrasive particles but also prevents recirculation of the solid-fluid mixture back to the impeller. Two types are available: one for fine materials, which is resistant to chemical action, and one that uses hard metal alloys for handling sharp edge solids. Allen-Sherman-Hoff Co., 259 E. Lancaster Ave., Wynnewood, Pa.

Circle No. **6** *on Reply Card*

Miniature Transducer

. . . changes pressure into a voltage that can be read on a voltmeter, observed on an oscilliscope, or fed into a recording system. Only 1 in. in diameter, the small transducer can be mounted in pressure vessels and pipe without obstructing the flow or causing turbulence. Because there are no mechanical linkages, errors caused by friction and wear are eliminated. Pressure ranges measured are from 0-15 and 0-500 psi for absolute, differential and gage measurements. Operation is possible up to 450°F. Schaevitz Engineering, P. O. Box 505, Camden 1, N. J.

Circle No. **7** *on Reply Card*

Mass Flowmeter

. . . provides a continuous reading of the flow of liquids and gases. It does not depend on density, temperature of viscosity. "Inertial Mass Flowmeter" measures flow by imparting a known, constant angular velocity to the fluid flowing through the meter. The torque required to stop this rotation is directly proportional to the mass flow, and is measured by a calibrated spring whose deflection is proportional to the torque. Deflection is sensed by a signal generator and gives a voltage proportional to true mass flow. Inertial Instrument Inc., 2029 Broadway, Santa Monica, Calif.

Circle No. **8** *on Reply Card*

NOTE: For more information on these items, use the Reader Service Reply Card on pages 133 and 134 of this issue. For information about current new products, processes or literature please turn to the regular "What's New" section beginning on page 135.

Readers as Tops in Interest Last Year

Literature

Heat Exchanger Data

. . . to aid in selecting water-heating equipment: *Catalog 552* deals with instantaneous heaters and storage heater coils. Sizes and dimensions, temperature rise conversions, and pressure-temperature conversions are presented in chart form. Simplified performance curves are also included. E. C. Cooley Co., 1186 Folsom St., San Francisco, Calif.

Circle No. **9** *on Reply Card*

Thermocouple Data Book

. . . describes construction and industrial applications of thermocouples and radiation detectors: *Bulletin F-5228-3* is a 40-page booklet telling how to check thermocouples, how to make them, and how to size and select them. Included are tables of standard temperature-millivolt equivalents. Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill.

Circle No. **10** *on Reply Card*

LP Gas Story

. . . a review of its amazing success and consumption: *LP-Gas, The Cinderella Fuel,* is a brochure written for the layman. It tells the complete story of the gas—from its recovery from crude oil and natural gasoline to its many home uses. Gulf Oil Corp., Gulf Building, Pittsburgh, Pa.

Circle No. **11** *on Reply Card*

Hydraulic Tables

. . . and other engineering data: 28-page reference book for those interested in pumping and piping problems. This is a new edition of a previously published handbook. Aldrich Pump Co., 25 Pine St., Allentown, Pa.

Circle No. **12** *on Reply Card*

Heat Transfer Bulletin

. . . contains data and pictures for custom-built heat exchange equipment. *Bulletin HE* presents tables of heat transfer rates for various duties, several tubesheet layout tables, and a sample calculating sheet. Details of exchanger construction are described. Downington Iron Works, Inc., Downington, Pa.

Circle No. **13** *on Reply Card*

Refining Processes

. . . and their history: a 24-page description in nontechnical language of major petroleum processing methods. Beginning with a simple explanation of octane number, the booklet progresses to a summary of the differences in simple distillation, thermal cracking, fluid cat cracking, and other refining techniques. Public Relations Dept., Universal Oil Products Co., 30 Algonquin Road, Des Plaines, Ill.

Circle No. **14** *on Reply Card*

Barometric Condensers

. . . their use and theory: *Bulletin 5AA* covers condenser theory and operation for many types. Descriptions of the parallel and countercurrent flow types, and information pertinent to the selection of condensers under varying conditions is presented. Schutte and Koerting Co., Cornwells Heights, Pa.

Circle No. **15** *on Reply Card*

Technical Data Books

. . . in pocket-size: *Lefax Catalog for 1956* lists all the data books that are available for purchase. Some of the subjects covered include metals, piping data, steam engineering, petroleum engineering, hydraulics, and conversion tables. All books are printed on 6¾ and 3¾-in. sheets. Lefax Publishers, Philadelphia, Pa.

Circle No. **16** *on Reply Card*

Temperature Table

. . . for conversions from —460 to +4000 degrees, in a handy 8½ x 11-in. form. This two color chart converts Fahrenheit to Centigrade, or vice versa. Included on the charts are temperature ranges of many sensing elements, with maximum limits for each type included for continuous and intermittent service. Thermo Electric Co., Inc., Rochelle Park Post Office, Saddle Brook, N.J.

Circle No. **17** *on Reply Card*

Heat Exchangers

. . . for process industries: 18-page brochure, *Lummus Standard Heat Exchangers for Process Industries,* describes the manufactured equipment as well as the data required for its design. Tables of effective surface area, film co-efficients, pressure drops, fouling factors and tube characteristics are included. Lummus Heat Exchanger Div., 385 Madison Ave., New York 17, N. Y.

Circle No. **18** *on Reply Card*

New Instruments for HIGH PRESSURE

Here's How Tomorrow's Processes Above 10,000 psi Will Be Measured

By W. ADAMSON
The M. W. Kellogg Co.

HIGH PRESSURES—meaning above 10,000 psi—were rarely met by the instrument engineer until a few years ago. True, there were a few commercial plants in the country that used pressures of 9000 to 11,000 psi for the production of ammonia. And during the war and immediately afterward, several plants were placed in operation that used over 10,000 psi for the production of polyethylene.

But today the "pressure barrier" of 10,000 psi no longer exists for the instrument engineer. Natural pressures exceeding this figure have been found in the petroleum industry; well pressures above 10,000 psi are not uncommon and most Christmas trees are rated at 15,000 psi. Coal hydrogenation uses pressures as high as 100,000 psi for the production of benzene, toluene, aniline and cresols. Pressures of 150,000 psi have been used by ordnance workers to season cannon bores (autofrettage). Many industrial laboratories are studying polymeric substances that use production pressures in the 100,000 to 200,000 psi range. And the latest advances—shock-tube experiments, nuclear explosions, etc.—are creating a new high pressure technology.

To help tame and accurately measure these high pressures, new instruments have been developed and old ones modified. Usually the primary elements are considerably different from those used in conventional applications. These are described in the following sections.

Measuring Temperature

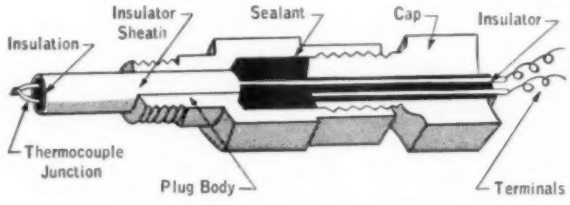
Temperature indicators, recorders and controllers with thermocouples, resistance bulbs and filled systems that are normally used on any job can also be used for high pressure service. However, the size and shape and method of attachment of the primary temperature measuring element present problems.

In extremely high pressure service, pipe sizes become very small. In the 30,000 psi range the pipe size is usually below 1 in. and becomes even smaller as the pressure range increases. Vessels will have exceptionally thick walls, varying from 3 to 6 in. or even thicker.

By taking the line of least resistance, i.e., not making holes in the pipe or equipment, it's possible to measure the temperature with a skin type element. This will avoid the problem of sealing high pressure process fluids, but has the disadvantage of slow response. Temperatures measured by skin type elements have a slow response and are unsuitable for control applications.

Another approach is to blind drill the thick vessel wall and bring the sensing element close to the flow. A thermowell may or may not be required. The problem of sealing against the high pressure is then mechanical and can be solved by a Bridgeman-type seal, with lens rings providing a minimum of metal contact.

Because the pipe sizes of high pressure service are extremely small, the sensing elements that are used must be small, too. This means that resistance elements and filled bulbs must be designed especially for this application because of their inherent characteristics. The thermocouple, on the other hand, offers definite advantages for high pressure applications because its size will not affect its accuracy. A basic thermocouple adaptable to high pressure work is shown below.



HIGH PRESSURE THERMOCOUPLE

To adapt a thermocouple for extreme pressures, the end connection can be modified to suit individual problems. The sealant, which can be Kel-F, lava, talc, Teflon or neoprene, is compressed between two porcelain insulators under a pressure of 50,000 to 10,000 psi. This is made possible by the high degree of confinement of the sealant. The actual compression is attained as follows for the unit pictured above.

1. Insulator No. 2 is retained in the body by a supporting shoulder.
2. The sealants are placed in the body cavity above this insulator.
3. The sealants are compressed when the gland follower containing Insulator No. 3 is forced down by tightening the cap.

The key prevents the gland follower from turning and causing wires to twist during assembly.

Table 1—Selecting Thermocouple Sealant for Different Operating Conditions

Sealant Material	Temperature Range	Pressure Rating	Chemical Resistance	Type of Material	Form
Lava	−300 to +1800°F	Vacuum to 15,000 psi	Excellent	Natural Fired Magnesium Silicate as mined (Like Soapstone)	Machined
Talc	−300 to +2000°F	7 psia to 115 psia	Excellent	Chemically pure, Magnesium Silicate	Loose Powder (250-300 Mesh)
Teflon	−90 to +500°F	Vacuum to 5000 psi	Excellent	Tetrafluoro-ethylene plastic	Machined
Neoprene	−40 to +200°F	Vacuum to over 20,000 psi	Good	Synthetic Rubber	Molded
Kel-F* Plastic	−320 to +390°F	Vacuum to 5000 psi	Excellent	Fluorocarbon Plastic	Molded or Machined
Kel-F* Elastomers	−20 to +450°F	Vacuum to over 20,000 psi	Excellent	Flourocarbon Elastomer	Molded

*Trademark of M. W. Kellogg Co.

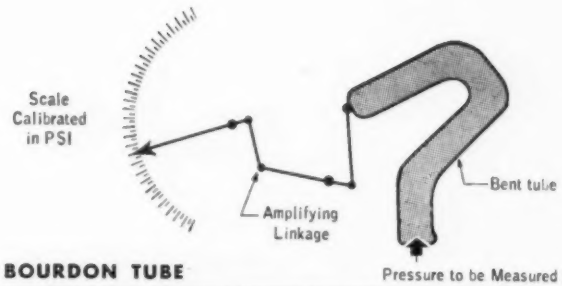
The use of a bare wire thermocouple, if the flowing medium will permit it, has several definite advantages over the use of a thermowell. These are:

- The low mass of the unshielded thermocouple provides a maximum rate of response to temperature changes. This minimum heat loss assures a close approach to the final temperature, and greater accuracy.
- The temperature range is limited only by the metallic combination and sealant selected. It can vary from —300°F to over 200° F. (See Table 1)
- Thermocouples can be replaced easily for maintenance or temperature selection.
- Depth of the hot junction is readily adjusted.
- Structural and pressure parts can be any machinable or precision cast material.

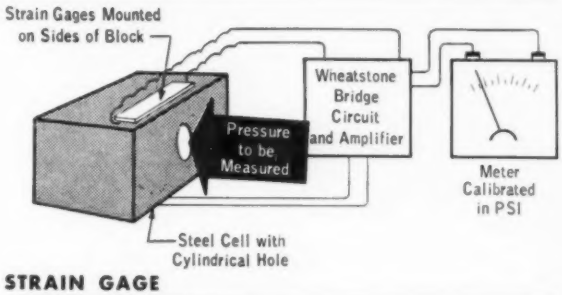
When the use of a thermocouple well is preferable, a thermocouple well consisting of a metal tube with ceramic or inert-oxide insulation can be used. This arrangement for measuring fluid temperature at high pressures has several advantages:

1. It fits small openings, with duplex conductors available in sizes from ¼ to 1/25-in. Single conductors are available in sizes from 1/32 to ⅛-in.
2. It is durable, with no visible deformation detected at 40,000 psi.
3. The metal sheath is available in many metals—Inconel, stainless steels (304, 310, 316 and 347), aluminum or copper. Sheathed extension lead wire is available in copper-nickel alloy or cold-drawn steel (plain or galvanized).
4. Temperature range is limited only by materials used for the sheath and thermocouple wire.

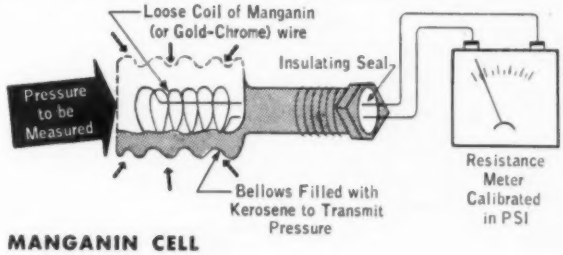
If both the thermocouple and the swaged well described above are mechanically joined, it's possible to devise a satisfactory method of measuring temperatures up to 40,000 psi pressure.



BOURDON TUBE


Strain Gages Mounted on Sides of Block
Pressure to be Measured
Wheatstone Bridge Circuit and Amplifier
Meter Calibrated in PSI
Steel Cell with Cylindrical Hole

STRAIN GAGE


Loose Coil of Manganin (or Gold-Chrome) wire
Insulating Seal
Pressure to be Measured
Resistance Meter Calibrated in PSI
Bellows Filled with Kerosene to Transmit Pressure

MANGANIN CELL

Measuring Pressure

Several sensing elements are available for measuring pressures in excess of 10,000 psi. The more important are: a. Bourdon Tube, b. Helical Element, c. Manganin Cell, d. Strain Gage Pressure Cell.

Bourdon Tube: The Bourdon tube h.p. element gage is similar to the type generally used except that the tube material is 316 stainless steel, using a special end connection of the Aminco, Autoclave type or equal. For safety, consideration should be given to the inclusion of a blowout disc and barrier wall with Bourdon tube gages.

Practically all manufacturers of Bourdon tube-type pressure gages can supply equipment for high pressure indication.

Helical Element: Helical elements were especially designed to supplement conventional elements, for high pressure service. They are made of 316 stainless steel and have 4 to 20 coils, depending on the pressure range. The 316 stainless steel is used because of its spring characteristics over a wide pressure range with negligible hystersis. Its corrosion resistant properties are generally acceptable for most applications.

The following table lists some of the standard minimum range spans presently available, with respective top pressures to which they can be subjected safely.

Minimum Recording Span	Rated Top Pressure*
5000	17,000
10,000	18,000
15,000	30,000
30,000	55,000
80,000	80,000

*Safe overrange pressure

Thus, a rated element of 30,000 psi can be used in an instrument reading full-scale the ranges 0-15,000, 5000-20,000, etc., with overrange limit at 30,000 psi. psi.

Manganin Cell: Manganin pressure cells were developed to meet requirements for a practical method of electrical high pressure measurement. The principle of the Manganin cell is not new, but it is just recently available commercially for precision measurement of extremely high pressures under industrial conditions.

The cell is a small pressure vessel that is installed on the high pressure line, and connected to an electronic recorder. A coil of Manganin wire (a patented alloy of copper, manganese and nickel) is sealed inside the pressure vessel with electrical leads brought out through the cap of the vessel. The coil is isolated by a flexible thimble filled with a non-conducting fluid. The thimble serves to isolate the coil from the process fluid—yet it transmits the pressure to the Manganin coil.

Measuring Extremely High Pressures

To measure extremely high pressures, several "yardsticks" have been discovered. These fixed points in physical behavior of special materials can serve as primary standards, and can be used for calibration of the limited equipment now available for high pressure measurements. Below are some of the fixed points that are recognized for this purpose:

Carbon dioxide boils at	0°C about	500 psi
Mercury melts at	0°C about	110,000 psi
Water melts at	30°C about	150,000 psi
Bismuth changes crystalline state near		350,000 psi

Anticipating Even Higher Pressures

To keep pace with the increasing use of higher pressures in industry and scientific research, the National Bureau of Standards has undertaken development of instruments and standards that will permit more accurate measurement of pressures up to 20,000 psi—and even higher.

Definite goals of the recently undertaken program include:

- Development of piston gages for absolute measurement of pressure up to 200,000 psi, with 0.01 percent accuracy.
- Determination of a series of fixed points on the pressure scale.
- Establish standards for calibration of dynamic pressure measuring instruments.
- Investigate properties of working pressure gages that utilize changes in electrical resistance with pressure.
- Design and construction of mercury columns to serve as primary standards and for measuring differential pressures up to 30,000 psi.

These studies will aid those doing work in ordnance at pressures of 150,000 psi; those in coal hydrogenation using pressures up to 100,000 psi; the study of crystal-forming reactions at pressures higher than 200,000 psi; and those doing research work in catalytic polymerization and hydrogenation.

The electrical resistance of the Manganin coil changes in direct proportion to the pressure impressed upon it. Sensitivity of measurement is within 25 psi in 100,000 psi.

The cell body is made of premium alloy steels, and auto-fretted to produce favorable residual stress characteristics. The Manganin coil is precision wound of carefully selected wire, factory tested to insure accurate response to the changes in pressure under service conditions.

Manganin pressure cells are available in ranges from 0-30,000 to 200,000 psi. These cells are higher in cost than some of the other methods.

Strain Gage Pressure Cell: The strain gage pressure cell consists of an elastic element that converts applied pressure into a proportional displacement upon which wire resistance strain gages are attached for measurement of this displacement. In high pressure service the eleastic element is a Bourdon tube, preferablely made of 410 stainless steel, because of its high elastic limits and overrange protection of 20% of rated operated pressure. To it are bonded four resistance gages wires in the form of a Wheatstone bridge. This Bourdon tube is of straight construction, and flattened in the center section where the strain gages are bonded. The pressure sensing element is hermetically sealed and operated by the flexing of the flattened section. Because this movement is very minute, these cells have a reasonable life.

The electrical output can be fed into an indicator or recorder. These cells are available in ranges of 5000, 10,000, 20,000 and 50,000 psi (also lower—200, 500, 1000, 2000 psi). With the exception of the 50,000 psi cell, all are factory tested to 200% of rated capacity. Accuracy of any cell is ± ¼% of rating between 0 and 100% of rated capacity. Included in the strain gage circuit is a temperature compensating resistor.

Measuring Flow

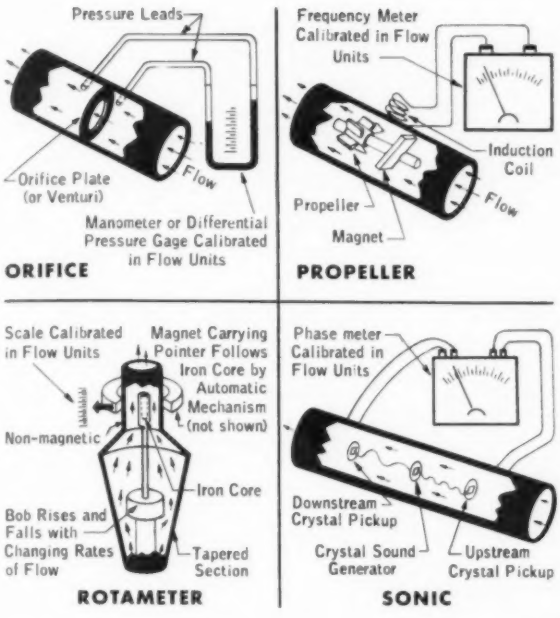
Primary elements for measuring flow in high pressure service appear to be plentiful, but many have limitations. Others that show great possibilities will require further development. The more available flow elements are of the following type: a. Propeller, b. Rotameter, c. Orifice, d. Sonic.

Propeller Type: There are at least three propeller type flow measuring instruments available at the present time. They are of similar design and all operate on the same principle.

This type flowmeter consists essentially of three parts: (a) a flow sensing element, installed in the pipe line, and which produces an A-C output whose frequency is directly proportional to the rate of flow; (b) a converter that delivers a D-C voltage output proportional to the frequency of the A-C produced by the sensing element, and (c) a potentiometer that measures the D-C output of the converter to indicate, record or control directly.

The sensing element contains a rotor that spins at a rate proportional to the velocity of flow through the unit. The rotor has an internally mounted permanent magnet, and one rotation sets up an A-C voltage in a pick-up coil mounted on the outside of the housing. The frequency of this induced voltage varies directly with the speed of rotation of the rotor.

For high pressure service, the sensing element is furnished as a smooth sleeve-type that is inserted directly inside the pipe line. The pick-up coil is then mounted outside the high pressure line in a position opposite the rotor. Is is necessary that this section of the pipe line be



of non-magnetic material. With this construction, there is practically no limit to the operating pressure for the sensing element.

The following are the major specifications:

Mounting — Horizontal or vertical, with 4 pipe diameters upstream of element.
Accuracy — ± ½% instantaneous flow
Temperature — 1200°F
Pressure — Normal construction—5000 pst
Special construction—unlimited
Viscosity — No appreciable effect at viscosities below five centipoise, however, viscosity effects more pronounced in the smaller size sensing elements.
Flow Range — Depends on size but available for 0.09 to 250 GPM
Response Rate— Average to milliseconds

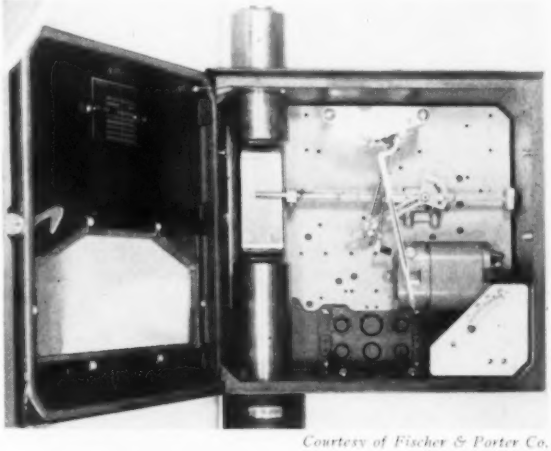
The sensing element is connected to the converter by a length of shielded single conducted cable. The frequency converter can be a separate unit or an integral part of a Brown or Bristol potentiometer.

Rotameters: Armored type rotameters are available for high pressure service. The material used will determine the pressure limitations. Materials available are stainless steel, K-Monel and Hastelloy. Aminco type end connections are used. Flow ranges vary from 0.002 GPM (min.) to 3.5 GPM (max.).

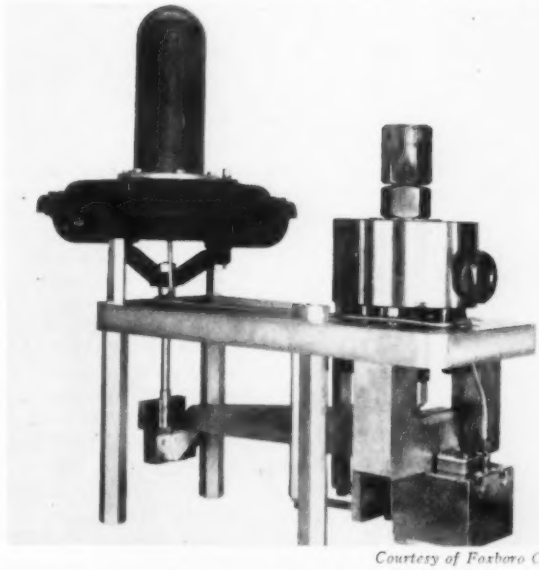
Orifice: The use of the orifice plate is the first method generally considered in measuring flow area at high pressures. The problem of the pressure leads and of holding the orifice plate are similar to problems listed earlier, i.e., they are mechanical, and can be solved by use of modified Bridgeman seal and/or bolted construction. The major problem is obtaining a device to detect a differential pressure of reasonable value. The Foxboro Company have available an inductive type D/P cell for a range of 0-400 in. to 0-600 in. H_2O and for 10,000 psi working pressure. They also have an inductive D/P cell for a working pressure of 25,000 psi with a comparable increase in the range.

Sonic: The sonic type flowmeter, which is now becoming commercially available for applications below 10,000 psi, has great potential for high pressure service. It measures flow of many liquids without creating a pressure drop or any obstruction in the line. The instrument uses sound waves to determine flow by measuring the phase difference between an upstream and a downstream ultrasonic wave. One transducer is aimed upstream and a second one downstream. An increase in the liquid flow rate increases the number of downstream pulses received, and decreases the number of upstream pulses. The difference is converted into flow capacities.

Original work in developing this type of instrument was done by H. P. Kalmus of the National Bureau of Standards. His early work is described on p. 201, *The Review of Scientific Instruments,* March, 1954. A different principle was developed by the H. L. Maxson Co. for Air Force applications of in-flight refueling, and subsequently developed by Fischer & Porter Co. for industrial uses. Within the next few years more should be heard of this meter.

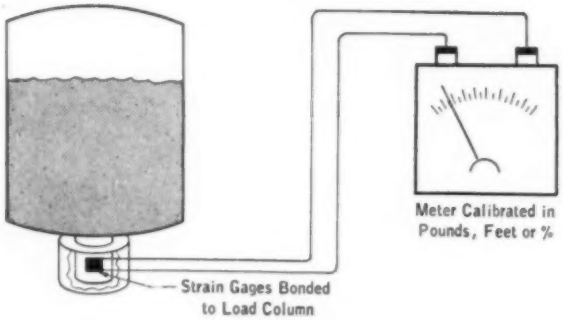


Courtesy of Fischer & Porter Co.

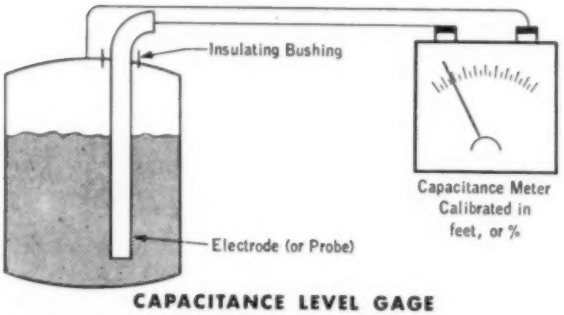


Courtesy of Foxboro Co.

TYPICAL MASSIVE CONSTRUCTION used in high pressure instruments: an armored rotameter (above), and a control valve for up to 30,000 psi (below).



LOAD CELL



CAPACITANCE LEVEL GAGE

Measuring Level

For level we get into the atomic age with instruments using radio-active material—also the capacity probe type. Some of these different types are: A. Gagetron, b. Ohmart-Density gage, c. Probe-capacity, d. Load cell, e. Displacer type.

Gagetron: The "Gagetron" gives level measurement or control via gamma rays without any connections electrical or mechanical through the vessel wall. The Gagetron uses geiger counter tubes and gamma rays. These rays are radiations similar to X-rays and are given off continuously by radioactive substances. Gamma rays cause discharges into the counter tube. The number of discharges per unit of time is proportional to the intensity of the radiation penetrating the counter tube. The strength of the ray depends on the size of the source, the distance between the source and the counter and the absorption of the material between these points.

These factors effect the results this way: doubling the amount of the radio-active material will double the number of counts; doubling the distance will divide the number of counts by four. The thickness of various materials necessary to absorb 90% of the radiation are: 3 in. of steel, 1 9/10-in. of lead, and 15 in. of water. A change in the density of the material will also change the counting rate.

Ohmart-Density: The Ohmart density gages use an ohmart cell that, when exposed to radioactivity, produces an electrical current that varies in value as a function of the amount of radiation received by the cell. This is done without use of any external high voltage electrical source. When radioactive energy penetrates the cell, the filling gas is forcibly ionized, causing a flow of electric energy. This current can be measured, indicated and recorded on conventional instruments. The cells are not a stock item; each is made for a particular application.

Probe-Capacity: The probe or capacity type operates on the basic principle of a capacitance bridge. A simple capacitor consists of two parallel plates or two concentric cylinders. As in a simple capacitor design, the rod-type electrode inside the vessel walls is identical to the capacitor formed by the concentric cylinders. The dielectric constant of gases, including air, is approximately 1, while most granular solids or liquids have dielectric constants between 2 and 80. Consequently, when a vessel is empty the capacitance of a probe in a vessel is at a low value. As the level rises, the capacitance changes. It is then only necessary to measure this change in capacitance by means of a capacitance bridge type circuit and convert it to a readable signal.

The problem in its use in high pressure is again the type of connection to the vessel. As with the temperature element, the sealing problem is purely a seal, i.e., minimum contact seals, lens, rings, etc.

Load Cell: The load cell is actually a weight device and works on the same principle as the strain gage pressure cell. It can be used in compression or in tension. The mounting problems may be in excess of these problems presented by high pressure. There is apparently a very fine art in using this type of equipment. Hercules Powder Company has made a comprehensive study of this means of measuring level, and a review of its tests is given on p. 916, *Mechanical Engineering*, Nov. 1953.

Displacer: The displacer type is similar in construction to standard units used in low pressure services but designed to meet the higher pressure requirements.

Control Valves

Excessively high pressures generally require a control valve designed for the particular application. The various manufacturers should be contacted to determine whether they now have valves for this service, because many of them have made valves for service in 30,000 psi operating pressure range. In the lower ranges of high pressure, control valves are available from most vendors.

Acknowledgment

The author wishes to express his appreciation for the contributions made to this article by his colleagues at The M. W. Kellogg Company. Also, he gratefully acknowledges the helpful cooperation of the instrument companies that contributed the illustrations and much of the information for this article.

The drawings used with this article by Mr. Adamson are based on work which appeared originally in the M. W. Kellogg Co. publication, *The Kelloggram*, Issue No. 3, 1955.

Meet The Author

Mr. Adamson

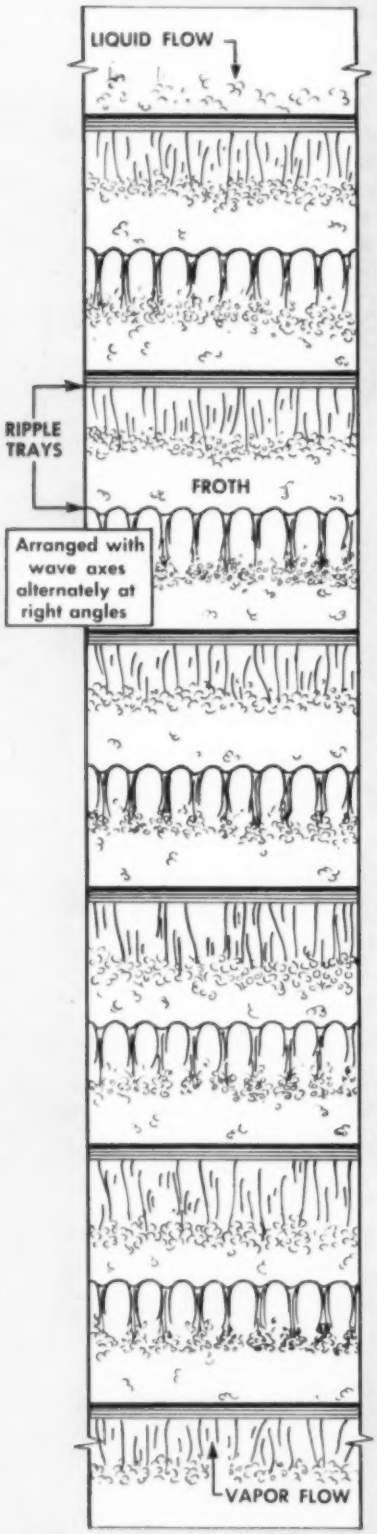
William H. Adamson is an instrument engineer with The M. W. Kellogg Co., which he joined in 1935. His work on instruments included a 3-year hitch after the last war on a special project for Kellogg on analytical instruments. Bill finds that active membership in both the American Society of Mechanical Engineers and the Instrument Society of America requires time off from home duties in Little Falls, New Jersey. He attended the Newark College of Engineering, Newark, New Jersey.

For High Pressure Work

These Companies...Make This Equipment

Aero Research Instrument Co. 1040 Grand Ave. Chicago 22, Illinois	Thermocouples
American Instrument Co., Inc. 8030 Georgia Ave. Silver Spring, Maryland	Control valves Indicators Thermocouples
The Annin Co. 6570 E. Telegraph Road Los Angeles 22, Calif.	Control valves
Autoclave Engineers Inc. 2930 W. 22nd St. Erie, Penn.	Valves and fittings
Baldwin-Lima-Hamilton Corp. Testing Equipment Division Philadelphia 42, Penn.	Pressure cells
Barksdale Valves 5125 Alcoa Ave. Los Angeles 58, Calif.	Control valves
Black, Sivalls & Bryson, Inc. 15. N. Cincinnati Tulsa, Oklahoma	Control valves
Brooks Rotameter Co. P. O. Box 432 Lansdale, Penn.	Flow Indicator
Chemiquip Co. 6 E. 97th St. New York, N. Y.	Pressure snubbers
Conax Corp. 4515 Main St. Buffalo 21, N. Y.	Thermocouples
Crescent Engineering & Research 11632 McBean St. El Monte, Calif.	Pressure indicators Flow indicators
Crosby Steam Gage & Valve Co. 43 Kendrick St. Wrentham, Mass.	Pressure indicators
A. H. Emery Co. Pine St. New Canaan, Conn.	Level indicator
Fielden Instrument Division Robertshaw-Fulton Controls Co. 2920 North 4th St. Philadelphia 33, Penn.	Level indicator
Fischer & Porter Co. 275 Warminster Road Hatboro, Penn.	Flow indicator
Fisher Governor Co. Marshalltown, Iowa	Level indicator Control valves
Foxboro Co. 38 Neponset Ave. Foxboro, Mass.	Pressure indicator Flow indicator Level indicator
Hammel-Dahl Co. 175 Post Road (Warwick) Providence 5, R. I.	Control valves
Harwood Engineering Co., Inc. Common & Main Sts. Walpole, Mass.	Pressure indicators (Manganin cell)
Heise Bourdon Tube Co. Brook Road Newtown, Conn.	Pressure indicator
Helicoid Gage Division American Chain & Cable 929-B Connecticut Ave. Bridgeport 2, Conn.	Pressure indicator
High Pressure Equipment Co. 1224 Linden Ave. Erie, Penn.	Valves and fittings
Industrial Engineering Corp. 525 E. Woodbine Ave. Louisville, Kentucky	Testing equipment
Instruments Inc. 122 N. Madison Tulsa, Oklahoma	Level indicator (Gagetron)
Jerguson Gage & Valve Co. 87 Fellsway Somerville 45, Mass.	Pressure indicator Level indicator
Mason-Neilan Regulator Co. 1190 Adams St. Boston 24, Mass.	Control valves
Minneapolis-Honeywell Regulator Co. 4493 Wayne & Windrim Aves. Philadelphia 44, Penn.	Control valves
Norden-Ketay Corp. Wiley St. Milford, Conn.	Pressure indicator
Norwood Controls Detroit Controls Corp. 934 Washington St. Norwood, Mass.	Pressure indicators
North American Philips Co., Inc. 750 S. Fulton Ave. Mount Vernon, N. Y.	Testing equipment
Ohmart Corp. 2236 Bogen St. Cincinnati 14, Ohio	Level indicator (Ohmart-Density gage)
P-K Industries Inc. 27 Porete Ave. N. Arlington, N. J.	Control valves
Potter Aeronautical Co. Route 22 Union, N. J.	Flow indicator
Pressure Products Industries, Inc. Hatboro, Penn.	Valves and fittings
Taylor Instrument Co. 95 Ames St. Rochester 1, N. Y.	Pressure transmitter Level indicator
Thermo Instruments Belmont, Calif.	Pressure probe Level probe
U. S. Gauge Div. Clymer Ave. Sellersville, Penn.	Pressure indicator
Waugh Engineering Co. 7842 Burnet Ave. Van Nuys, Calif.	Flow indicator

NOTE: The editors of PETROLEUM PROCESSING have made every effort for completeness in compiling this list. It was developed independently of Author Adamson's preceding article. Readers are invited to submit comments, criticism, changes or additions.



HOW THE RIPPLE TRAY LOOKS
when installed in a fractionating column

Fractionation Your

A BOOST in capacity of about 150% in the original design throughput of a crude distillation unit has resulted from a new fractionating tray design, trade-named the "Ripple Tray."

As shown in the illustration below, the new tray is formed by pressing sinusoidal waves into flat, perforated light gage sheet metal. No downcomers are required because both the liquid and the vapor pass through the perforations. The waves help redistribute liquid as it flows from the bottom of one tray into the froth on the tray below in counter-current contact with rising vapor.

Specific advantages claimed for the Ripple Tray, based on a wide variety of applications including the above-mentioned crude still, are:

- High capacity and simple construction.
- Tray efficiency insensitive to load changes over a wide range of operating conditions.
- Relatively low pressure drop, and the tray is self-cleaning.

For the crude unit mentioned, preliminary operating data have shown no apparent limits on the operation at a crude throughput rate of 31,500 b/sd. The original design capacity with bubble trays had been 20,000 b/sd, and any attempts to push the rate beyond this had adverse effects on fractionation efficiency.

In modifying this unit, Ripple Trays were installed in the same shells in all locations affected by loading. This is shown in the accompanying table. Fractionation in general has been reported comparable with the best obtained with the original bubble cap installation when operated at the respective column loadings.

Other commercial applications of the new tray—already in operation or now under construction—include:

- Naphthalene purification.
- Phenol purification.
- Tar separation.
- Gasoline re-running.
- Atmospheric and vacuum crude distillation.
- Demethanizing.
- Depropanizing.
- Styrene re-running.
- Ethylene-ethane fractionation.
- Propylene recovery.
- Isopentane recovery.
- Gasoline stabilization.
- Cracked gas quenching.
- and a large number of organic chemical separation, superfractionation, recovery, absorption, and scrub-

CLOSE-UP shows how new fractionation tray design is constructed

Problem?

Here's an unusual new "ripple" tray design aimed at improving vapor-liquid contacting

bing applications involving vapor-liquid contacting.

The ripple tray and its performance in a semi-works experimental run on ethanol-water fractionation was reported a few weeks ago to the American Institute of Chemical Engineers at Boston, Mass., by Dr. Margaret H. Hutchinson, Stone & Webster Engrg. Corp., Boston, and R. F. Baddour, Massachusetts Institute of Technology. The patent number of this Stone & Webster development is U. S. 2,767,967.

One function of the wave in the tray is to act as a predetermined discharge point for the liquid. In addition to forcing liquid distribution, the waves help provide flexibility with respect to vapor and liquid loads on any given tray. They also supply a third-dimensional design variable by which the desired load ranges can be accommodated.

In the usual construction, Ripple Trays consist of sections framed by vertical rims and narrow enough to pass through an 18-in. manhole. Sections are bolted together in the shell. The complete tray is then clamped to a support ring. When installed in towers up to 9 ft in diameter, the trays require no additional beams for support. Trays are also being manufactured as one-piece affairs with removable supports.

Any structural metal can be used, but Type 410 stainless steel is most common. Carbon steel is avoided because of the danger of hole enlargement.

Simple slotted distribution "boxes" are the usual means of introducing liquid above the top tray. In any event, no redistributors are required.

A number of standard types of trays have been developed, although special modifications can be made. For clean service conditions, perforations of ⅛ in. in diameter are used: for fouling conditions, holes are made somewhat larger.

The total open area is within 15 to 30% of tower cross sectional area in all trays. The wave depth is variable, depending upon design liquid loading. Shallowest wave depths are used for low loadings—under 500 gal/hr/sq ft: deepest waves are for high loading—over 2000 gal/hr/sq ft.

Commercial performance data on the trays have substantiated data obtained in semi-works experimental runs on ethanol-water separations. In one full-scale installation—absorption of sulfur dioxide from a carbonate solution—overall efficiency was 80-90%. In another—recovery of naphthalene from coal tar—average overall efficiency ran to 75%.

Data on Ripple Tray Installations in a Crude Distillation Unit

Tower	Section	Diam. ft & in	Tray Spacing Inches	Operating Pressure	Design Loads corres to 30,000 b/sd Max. F_G*	Max. L_G*
Primary	Rectifying	5 — 0	24	40 psig	1.92	600
Atmos.	Rectifying	9 — 6	30	atmos.	2.20	493
Vacuum	Rectifying	13 — 6	30	vacuum	1.67	360
Stabilizer	—	3 — 0	20	200 psig	1.15	2600
Visbreaker flash ..	—	2 — 6	12	45 psig	1.68	240

*F_G = cross tower factor, $u(\rho v)^{\frac{1}{2}}$
u = linear vapor velocity based on gross cross-sectional area of column, ft/sec
ρv = vapor density, lb/cu ft
L_G = liquid rate based on gross cross-sectional area of column, gal/hr/sq ft

Illustrations

The photographs showing the new ripple trays accompanying this article were furnished through the courtesy of Artisan Metal Products, Inc.

EASY INSTALLATION through normal manhole is one construction feature of new Ripple Tray design

THIS MONTH'S M&C PANEL FEATURE

Why Full-Time Technical Studies

By VERNON J. LOYD, Supervisor, Maintenance and Corrosion Group, Refinery Engineering Div., Socony Mobil Oil Co., Inc.

WE BELIEVE the next logical step in refinery maintenance will be to *make comprehensive technical studies of all factors that influence maintenance performance and cost—to develop improvements that will lead to substantial increases in refinery realization.*

This will follow from the efforts made in recent years to improve effectiveness and reduce cost of refinery maintenance. Though much progress has been made, more is needed to get maximum return from maintenance expenditures, and to insure that maintenance keeps pace with refining technology.

Progressive thinking and a more realistic approach than has been used in the past will be needed for such an effort. The studies will be designed not only to reduce costs wherever possible, but also to find improvements that sometimes may call for greater maintenance expenditures, but will result in larger overall benefits.

Potential benefits from such a study program will amply justify the needed effort and expenditures.

Justifying a Basic Study of Refinery Maintenance Operations

Can a strong case be made for a comprehensive study of refinery maintenance? We believe so, in view of the continuing concern about maintenance cost and performance, despite recent improvements; the nature and history of those improvements; and the many possibilities for improvements that have *not* been investigated.

Maintenance costs are of genuine concern, because they represent by far the largest single item of refinery expense. They have increased substantially in recent years because of rising wage and materials costs. While maintenance costs are controllable, there is no easy way to measure the value received for dollars spent.

Maintenance performance is also becoming of increasing concern as larger and more complex processes appear. With the greater and greater capacities of operating units, the influence of maintenance on stream efficiency is magnified. These larger units make it increasingly important that operating interruptions and downtime be minimized.

Now let's look at improvements in maintenance in recent years, remembering that there are two basic ways to reduce costs: 1) by improving the effectiveness of work performance, and 2) by reducing the volume of work being done.

We have seen realignment of maintenance organizations; construction of central shops and warehouses; provision of better tools and mobile equipment; training of mechanics; development of supervisors; inauguration of work planning procedures; and many other improvements. However, these efforts have been concerned primarily with getting work done effectively.

Work reduction, as a key factor in reducing maintenance costs, has been given too little recognition. Most work reduction examples have dealt with specific problems of corrosion control, preventive maintenance, improved operation of equipment.

Apparently, the refining industry has generally accepted the idea that the volume of maintenance work is fixed, and that the main hope for reducing costs lies in doing the work more effectively.

Analyzing the improvements listed, we find that they are solutions for fairly obvious problems. The order in which they appeared in many companies leads us to conclude that the improvements were not the result of organized programs—but that each project was an end in itself, designed to meet a specific need at a given time. A limited study was made, and an action taken. Then little was done until another need became very evident.

The piecemeal approach is not good. The usual result is that too little is done too late. Limited studies do not consider all maintenance factors in their proper perspective, thus often focus attention on symptoms rather than causes. The unfortunate result is that improvements are not made in the order that will bring the greatest long-term benefits, nor do they always solve the basic problem.

For example, we have noted that work planning usually receives proper attention only after a number of other steps have been taken, yet almost everyone would agree that planning pays off regardless of other conditions.

Looking at central mechanical shops, we find that some of them appear to be only the collection of old ideas and methods under one new roof. As such, they fail to produce the expected economies.

Lack of progress in work reduction calls for serious attention. Surely there can be no more direct way to reduce

This Month's Feature M&C Panelist

Mr. Loyd

Mr. Vernon J. Loyd, member of PETROLEUM PROCESSING'S Maintenance and Construction Panel, is Supervisor of the Maintenance and Corrosion Group, Refinery Engineering Div., Socony Mobil Oil Co., Inc., in New York City.

Mr. Loyd was born in Excelsior Springs, Mo., in 1914. He attended Iowa State College, earning a B.S. in Chemical Engineering in 1935. He worked one year with Anaconda Lead in Indiana, before joining Socony's East Chicago, Ind., refinery, where he served as Laboratory Tester, Unit Fireman, Loader, Chemist, Construction Engineer and Maintenance Superintendent.

In 1952, Mr. Loyd transferred to Socony's New York City headquarters as Senior Engineer, and was advanced to his present position during February of 1956.

# of Maintenance Are Needed Now

costs than by reducing the work required. And refinery maintenance, by its very nature and evolution, must surely be as fertile a field for work reduction as it has been for improved work performance.

Why then, has so little work been done on work reduction in refinery maintenance? We believe that there are two primary reasons. First, the possibilities for work reduction are not often readily apparent. Secondly, and far more to the point, the sparse amount of technical effort devoted to maintenance studies generally has not been enough to do justice to the fairly obvious problems.

Turn now to the program:

Starting A Work Reduction Program for Maintenance

In reviewing past performance and progress, we can conclude that most of us have failed to realize that the mechanical side of refining also needs its share of research, development, and technical service—even though we do recognize the need for spending millions of dollars every year to develop and improve processes.

To make progress in maintenance, we must now be willing to provide the means which make progress possible. Competent people must be assigned full time to the task, and be given the things they need to work effectively. These people should have only one responsibility—to study the entire maintenance function and the forces that play on it; to analyze maintenance costs in terms of work performed and equipment involved; and to develop improvements leading to reduced costs or other benefits.

The effort must be full time. There is enough precedent to predict that little will be done if work reduction studies are made on a part time basis. The people in the study group must have firm management support, cooperation of all refinery groups, and access to all helpful information and cost data.

First efforts by the study group should be on those things that promise greatest return.

Now, assume the need for a group in the refinery to study the problem of maintenance work reduction. The number of persons needed will depend on the size of the refinery and the total maintenance situation. For the average refinery we suggest a number no less than one per cent of the maintenance force, plus one. The men selected should have well rounded experience, inquiring minds, and a light regard for tradition.

The group's first activity might well be one of self education to familiarize itself with the entire maintenance function, and the forces that play on it. The men can start by reading the excellent material on this subject published in recent years. In addition, they should discuss their mission with supervisory and technical personnel in all refinery departments.

If self education is skillfully and objectively done, the persons in the study group should acquire a great deal of background information, and at the same time enlist cooperation by actively soliciting ideas and suggestions for improvements.

The next step should be to analyze maintenance costs to determine how and where maintenance dollars are being spent. Starting with over-all costs, the group will want to go successively into as much detail as plant records and cost data permit. A good knowledge of costs is essential, because it will guide the group to those areas where the greatest benefits can be gained.

The bulk of maintenance expense in most refineries will be on the process units, with labor costs accounting for about two-thirds of the total. This suggests that process units are a logical first choice for cost reduction efforts, with emphasis to be placed on reducing use of manpower.

Taking each process in turn, the group will want to know where and how the money is being spent. The ultimate objective: relating costs to actual jobs and pieces of equipment.

Cost studies will break down in many refineries, because the work records and cost data needed will not be available. This raises an important point—unless such cost information is available, it will be very difficult to determine the areas where improvements are needed badly.

Also, without adequate cost data, it will be difficult to measure the effectiveness of improvements. This is another area where a realistic approach is needed. We must be as willing to give this group the information it needs as we are to give others information on operating data, yields, and costs.

If cost information is available, the study group can get its teeth into the problem. Knowing where and how money is spent, by job and by piece

Treat a Broken Leg with Band-Aid?

Silly question? Yet most refiners do just that with their maintenance departments. They spend large sums to develop and improve processes and understand basic reaction mechanisms. But maintenance continues to grow like Topsy, trying to stay abreast of process developments with "chewing gum and baling wire" methods.

Maintenance is the largest single item of cost in operating a refinery, and as such deserves to be dignified with regular appropriations to study the basic principles and mechanisms of refinery upkeep. The rewards can be great for management willing to look past make-shift solutions for immediate isolated crises.

of equipment, the group can then ask "why" and start coming up with ideas for improvements.

Applying cost analysis to turnarounds, the group would ask questions about each job. Why is the work being done? Does a real need for it still exist? Can it be eliminated? Can it be done at longer intervals? Are there better work methods? Should better materials be used? Should new equipment be installed? Can operation of equipment be improved? In a new unit, can work be reduced or eliminated by changing layout, design, equipment, or materials?

Interesting results will come up in going through this "question" process systematically for each unit. The group will find some work being done for no good reason—as it delves deeper than the first obvious answer.

The group will find repetitive repairs and replacements being made because previous cost studies showed no payout for better materials, better corrosion control, or a new piece of equipment. The group will reopen each of these cases to see whether the same conditions still exist, and will be especially dubious of any calculations showing no value for unit streamtime, "because this job will not extend the turnaround." Often, four or five such jobs during a turnaround require an extra day or two of unit downtime.

Another item the group will learn is that the elimination of corrosion, erosion and fouling would leave little maintenance work needed. This would suggest that particular study be given to these problems. Many times, additional money could be well justified for better corrosion or erosion control, just by eliminating the need for frequent inspection.

For fouling, coking, scaling, and other deposits—the group will be amazed at what it costs for finding, unplugging, unheading, scaffolding, rigging and hoisting (in order to open up or dismantle equipment for cleaning), with all this work repeated after the equipment has been cleaned. Large expenditures might be justified to reduce or eliminate these major work sources. Crude desalting, water treatment, use of detergent inhibitors, and all other means should be investigated thoroughly.

If deposits cannot be eliminated, in-place cleaning with solvents and chemicals should get major attention. Steam-air decoking should be investigated for heaters not adaptable to chemical cleaning.

Where mechanical cleaning is still needed, work methods should be studied to find the most efficient means of dismantling and cleaning the equipment.

Excessive maintenance is often needed when equipment is operated far above design capacity. The group will study these situations to find the actual cost of such operations, not only in excessive maintenance but also in extended unit downtime for repairs. This will permit a true evaluation of whether such operations are economically desirable.

In other cases, the study group will find that equipment has been misoperated so that major repairs are needed. These cases should be studied to find the factors involved, and the steps needed to prevent repetition.

Results of Study Program for Maintenance Work Reduction

When turnaround studies are over, the group will be able to recommend many improvements to reduce costs, or improve unit onstream efficiency. And, the group will be able to give economic justification for the proposed changes.

One result of the studies will be factual data showing how much turnaround expense is caused by necessary, but non-productive work. This will give a sound basis for insisting on maximum length of runs consistent with good operation.

Another important result will be the collection of valuable information to guide the design of future units. The group will find that a lot of expensive maintenance work could have been avoided at little extra cost if the initial planners and designers had properly recognized maintenance requirements and experience.

The group will also be able to show, time after time, that additional investment for better equipment or materials would have paid handsomely under a wait-and-see policy.

There is still vital need for translating knowledge gained by the group into new units designed to allow efficient and economical maintenance. The group, armed with factual cost data to justify additional initial investment, can help supply this long felt need for "maintenance designed" process equipment. It is very possible that this basis alone might justify the efforts in an expanding refinery.

We have used turnaround work as an example of how the group might function. In actual studies of process units, the total maintenance needs should be considered, and onstream maintenance should be analyzed in the same way. Possibilities for shortening turnaround time by doing more running maintenance work should be investigated.

This same approach should be used in other studies of maintenance work throughout the refinery—the work being done in order of importance indicated by initial cost analyses.

Work Performance Studies for Refinery Maintenance Work

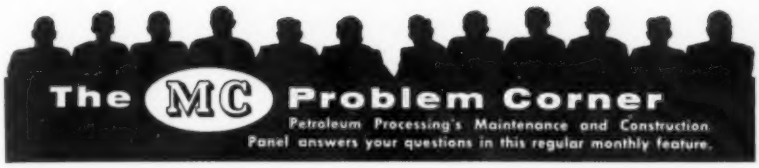
Concurrently with its initial efforts on process units, the group should begin studies of the factors influencing effective work performance. Such items as work authorization, planning and scheduling, shop facilities, tools, mobile equipment and material delivery should be studied. Enough work has been done in these fields so that recommendations for improvements can be soundly developed.

Work methods should be given special attention, because traditional methods may now be costly and outmoded. The group should take a fresh, basic approach to this problem. It's thinking should not be inhibited by giving consideration only to present methods.

Work performance studies are very important; they can lead to substantial long range benefits.

There will be other fields that the study group can explore. One example is equipment standardization, for heat exchangers, pumps and compressors, for instance. The group should be able to show that there is economic justification for standardization in a refinery—if all factors are considered.

In summary, we believe that maintenance will keep pace only if it is given full-time technical assistance to reduce work volume and improve effectiveness of work performance.


The MC Problem Corner
Petroleum Processing's Maintenance and Construction Panel answers your questions in this regular monthly feature.

How to Clean Slurry Bundles

What is the best way to clean tubes in our fluid catalytic cracking unit slurry tube bundle?

Refining, Gulf Coast

NORMALLY, severe fouling on the shell-side of these bundles is caused by coking of oxidized compounds, found in the virgin feedstock, onto the surface of the hot tubes. Feedstock that has been stored for any length of time in the presence of air can cause the feed exchanger to foul and lose as much as 85% of its exchange capacity in just a few weeks.

Slurry-side fouling problems seem to be consistently less severe than feed-side fouling. One Panel member states that they clean the slurry side of the exchanger by simply washing with water at approximately 100 psig.

Another Panel member reports that some refineries have almost eliminated the need to clean the slurry side of these bundles by circulating a hot gas oil, No. 2 fuel, No. 1 fuel or kerosine stream through at maximum rate as part of the normal shutdown procedure. Others clean fouled bundles with a high pressure water jet (2000-3000 psig) with a suitable side thrust and drive nozzle, such as shown in the sketch.

The preceding is when the slurry is through the tubes. When it is shell-side, the bundle must be pulled. High pressure water is fairly successful, and soaking in a hot gas-oil vat followed by high-pressure water wash will work. A unit such as that put out by Hydroblast cleans this shell-side quite successfully, either with or without a blast sand addition.

Feed-side cleaning is harder. On-stream cleaning, either chemically or mechanically, is hazardous because of the chance of valve failure, and the mechanical strains on equipment and manifolds when switching part of the equipment out of service while the remainder stays at operating temperature.

Back-washing the bundles with aromatic distillate at elevated temperatures without cutting the flow of slurry oil out of the tubes has had limited success for some companies. However, it is much better to take the bundles out of operation so that cleaning can be controlled.

Some companies claim it is best to pre-wash the bundle with hot aromatic distillate, followed by chemical cleaning.

Chemical cleaning can be quite successful, but the selection of cleaning agent depends on the feedstock and type of fouling. There are several organizations that specialize in chemical cleaning of exchangers, including Oakite Products Co.; Turco Products, Inc.; Dowell, Inc.; and others. Some of these companies furnish required chemicals and technical supervision, while others are equipped to perform the entire operation with special mobile equipment.

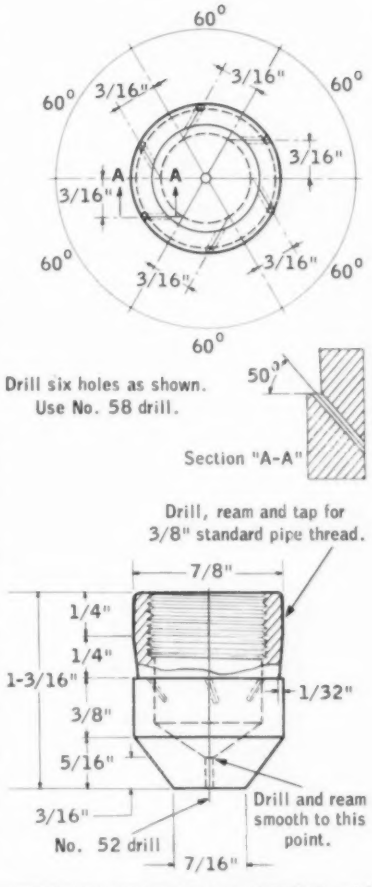
One chemical cleaning "must" is ample velocity and agitation to wash the deposit away as it is softened. Some help is possible by "blocking out" and perforating one of the bottom tubes to inject gas into the bundle to get agitation. Natural gas or compressed air have been used, but this is a hazardous procedure and should be avoided if possible.

Better chemical cleaning also results if the circulation system has a manifold so that the flow can be reversed every few minutes.

Bundle design will affect the ease with which it can be cleaned chemically. A tube bundle with 1-in. tubes on 1¼-in. square spacings is easier to clean than a similar one with triangular spacings.

Mechanical cleaning is best accomplished by removing the bundle from the shell, with channel and floating heat intact, and hitting it with high pressure hot water (600-800 psig) while the tubes are kept hot by passing steam through them. Another mechanical cleaning method used with some success combines a high pressure hot water stream with a wet sand blast. This is most effective with square pitched bundles.

While amines work wonders in preventing deposits on other tube bundles for one Panel member, he reports that he has had little success with amines in preventing deposits from forming on cat cracker feed exchanger bundles.



DESIGN FOR JET NOZZLE with suitable side thrust used for cleaning fouled cat cracker slurry bundle with high pressure water jet (2-3000 psig).

Got a Problem?

Why not send it to the M&C panel. Your questions should be specific, and on maintenance and construction. Include a sketch or photo if needed. But please limit each question to one subject. Address them to:

M&C Editor
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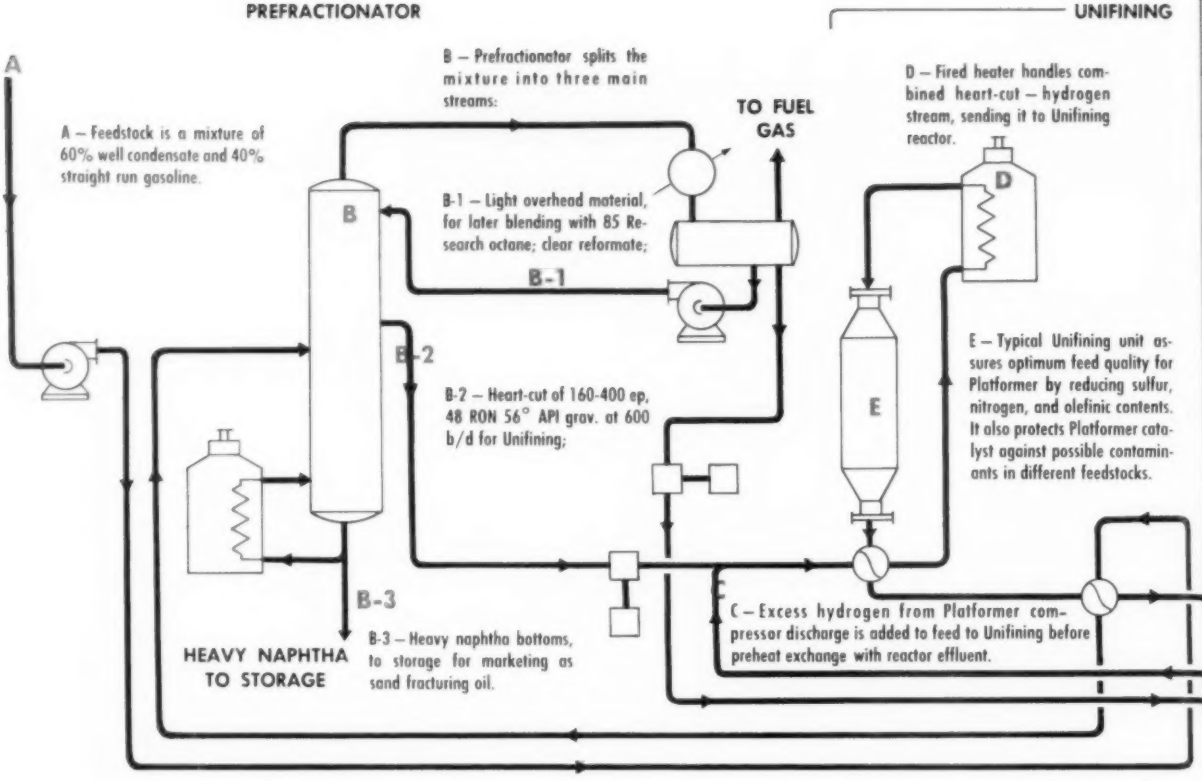
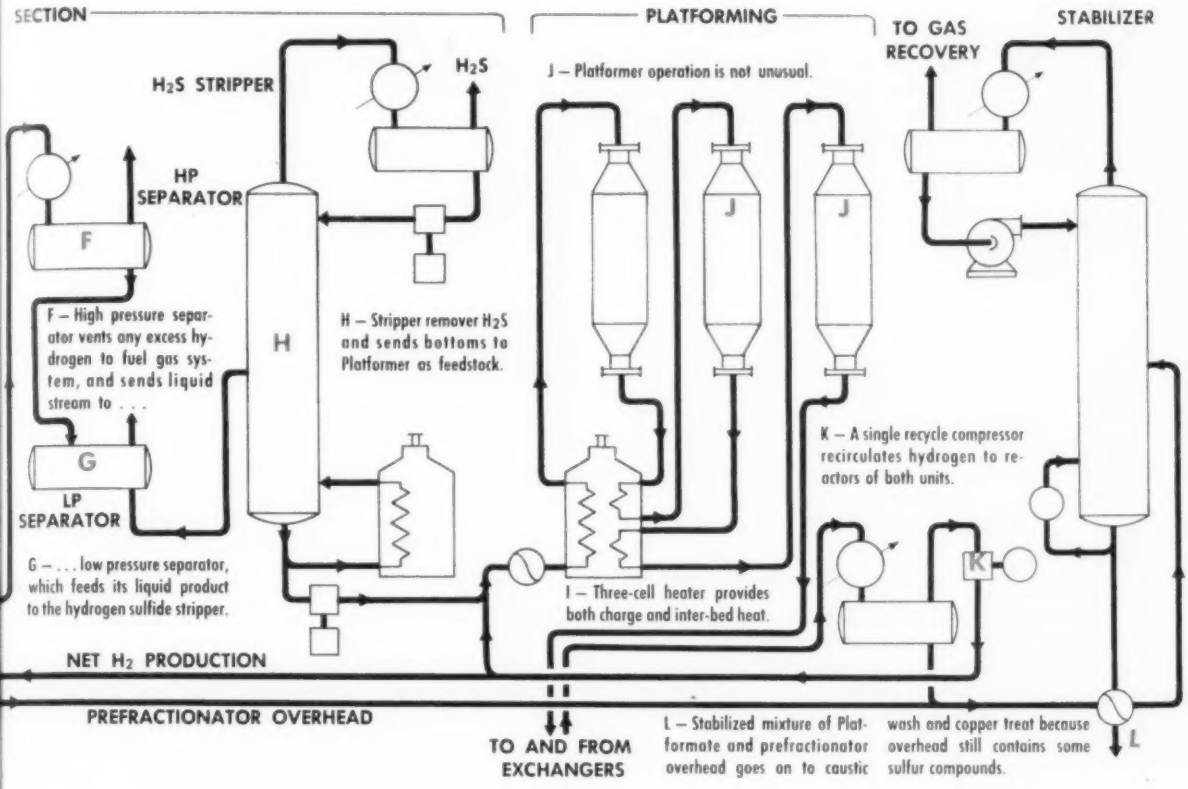

PREFRACTIONATOR
UNIFINING
A
A – Feedstock is a mixture of 60% well condensate and 40% straight run gasoline.
B – Prefractionator splits the mixture into three main streams:
TO FUEL GAS
B
B-1 – Light overhead material, for later blending with 85 Research octane; clear reformate;
B-1
B-2
B-2 – Heart-cut of 160-400 ep, 48 RON 56° API grav. at 600 b/d for Unifining;
D – Fired heater handles combined heart-cut – hydrogen stream, sending it to Unifining reactor.
D
E
E – Typical Unifining unit assures optimum feed quality for Platformer by reducing sulfur, nitrogen, and olefinic contents. It also protects Platformer catalyst against possible contaminants in different feedstocks.
B-3
HEAVY NAPHTHA TO STORAGE
B-3 – Heavy naphtha bottoms, to storage for marketing as sand fracturing oil.
C – Excess hydrogen from Platformer compressor discharge is added to feed to Unifining before preheat exchange with reactor effluent.

New Mexico's First Cat Reformer

THE FLOWCHART above and the table at the right tell the whole story. 600 b/d of Famariss Oil and Refining Co.'s 2250 b/d capacity are provided by the unusual setup shown here, one of the few in the country that operates on a mixed feed.

The table shows the cleanup performed on the charge stock by Unifining. Although the concentrations of arsenic and nitrogen compounds—as well as olefinic constituents—are within bounds in the initial charge, Unifining reduces them further. Most importantly, the Unifining unit supplys an essentially sulfur-free feed to the Platformer. The result, after blending with TEL and prefractionator overhead, is a 96 octane gasoline. The

HEATER and reactor sections for Platforming and Unifining units. Column at left is for feed preparation, that at right is Platformer stabilizer.


SECTION
PLATFORMING
TO GAS RECOVERY
STABILIZER
H2S STRIPPER
H2S
J – Platformer operation is not unusual.
HP SEPARATOR
F
F – High pressure separator vents any excess hydrogen to fuel gas system, and sends liquid stream to . . .
H
H – Stripper remover H2S and sends bottoms to Platformer as feedstock.
J
J
K – A single recycle compressor recirculates hydrogen to reactors of both units.
G
LP SEPARATOR
G – . . . low pressure separator, which feeds its liquid product to the hydrogen sulfide stripper.
I – Three-cell heater provides both charge and inter-bed heat.
K
NET H2 PRODUCTION
PREFRACTIONATOR OVERHEAD
TO AND FROM EXCHANGERS
L – Stabilized mixture of Platformate and prefractionator overhead goes on to caustic wash and copper treat because overhead still contains some sulfur compounds.
L

How It Works on a Mixed Feed

refinery produces a regular and government grade as well as a premium, for local markets.

About Famariss. Famariss Oil and Refining Co. is the outgrowth of a crude oil operation established less than ten years ago. In 1949 Walter Famariss leased a small refinery owned by Warren Petroleum Co. in Monument, N. M., to provide a market for the modest amount of crude oil he was then handling. Original production was 450 b/d and then grew to 750 b/d. In 1951 the company built a TEL blending plant and tankage and entered the local finished gasoline market. The refinery was later moved, its capacity upped to 1,200 b/d, and a Unifining-Platforming combination added to raise output to the present 2250 b/d.

Famariss is considering still further expansion, which will be based on its service station's market—now covering New Mexico, western Texas, and eastern Arizona. If expansion does come, both the Unifining unit and the Platformer can be raised to 1000 b/d.

Typical Inspections of Charge Stock and Products From Unifining-Platforming Units

	Charge to Unifining*	Charge to Platforming**	Platformate Product
Gravity °API	56.4	56.5	51.7
ASTM Distillation, °F			
IBP	163	160	110
10%	196	194	170
50	**249**	**248**	**236**
95	373	372	393
EP	398	398	424
Total Sulfur, wt.-%	0.14	0.001	...
Arsenic, ppb	1	<1	...
Total Nitrogen, ppm	1	0.5	...
Bromine Number	1.0	0.3	...
Hydrocarbon Type Analysis			
Paraffins	57.0	57.3	55.0
Olefins	0.4	Trace	...
Naphthenes	33.5	33.6	5.0
Aromatics	9.1	9.1	40.0
Reid Vapor Pressure	...	...	4.0
Octane Rating			
Research, clear	48.0	...	85.0
+ 3 ml TEL/Gal	...	...	96.0
Yields, vol% of fresh charge	100.0	100.0	88.8

Note: Reformate analyzed here has not been mixed with prefractionator overhead.
*A blend of 60% gas well condensate and 40% straight-run gasoline.
**Same as product from Unifining.

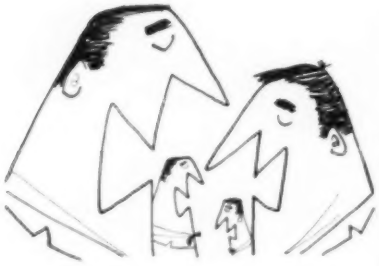
What Do Oilmen Want in the

By STUART D. BOYNTON, Editorial Assistant

MANAGEMENT is looking for the well-rounded engineer or scientist in the oil industry today. While no one is ready to sell technical skill short, most have come to realize that technical work is not the whole job.

To find out what else counts, PETROLEUM PROCESSING surveyed a group of men in refining, research and engineering companies in different parts of the country. Through personal interviews and by mail we questioned men in the middle and top levels—men with a lot of experience in career building. They singled out as important assets the five points on this page. None of these points has anything to do with technical skill or knowledge. Yet a couple were called "as important as technical skill." Not so many years ago, they would probably have been dismissed as "extras" or actual liabilities. Today our ideas have changed, and it is usually recognized that there is more than sharp technical work in the success of an engineer or scientist.

Here are the results of our survey:



1 Skill in Communication

Many think of speaking and writing as two aspects of the art of "communication." A person will vary his language and technique to fit the occasion and solve his essential problem—making his ideas bridge the gap between himself and his audience. Skill in making contact is an important asset for the technical man. Here's how L. R. Goldsmith, general manager of technical departments for Shell Oil Co., rated it:

"The man who gets ahead will be the man who combines good, solid technical ability with the ability to get along with others and with skill in communication. This skill is basic to both effective speech and good writing. Organization of ideas is important, and simple language is best, of course. But it's important to remember that above all, a technical man has to communicate with others both down the ladder and up."

Writing itself came up often during our survey. Probably the best diagnosis of the technical man's shortcomings was made by John T. McCoy, manufacturing department coordinator of Tidewater Oil Co.:

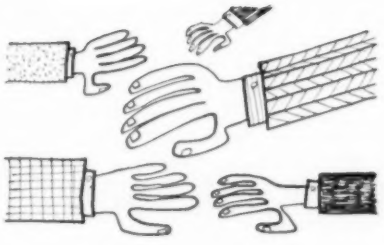
"The engineer tends to feel that calculation—getting the answers—is important and that writing is not. He must realize that the man who can write reports is going to move ahead, and the man who can't, will be held back."

Does this sound like old stuff? Well nearly everyone we contacted—by mail and in person—laid stress on writing. They feel that the technically trained person still hasn't learned to write in a natural, direct way. Our findings clearly showed that a real value is placed on his literary efforts. Management wants to see reports, letters, memos, etc., that are concise and readable.

Speaking before groups is often the technical man's best chance to get ideas across to his co-workers. W. W. Scheumann, vice-president of Cities Service Research and Development Co., had this to say:

"For a technical man to be able to express himself in front of a group and tell his story in understandable language is a terrific asset in our profession and means a lot to the individual."

It's no surprise that many companies are offering special training in public speaking, conference leadership, report writing and other communication skills. But these programs take time, require small groups, and in practice are usually limited to people picked from middle-level management.



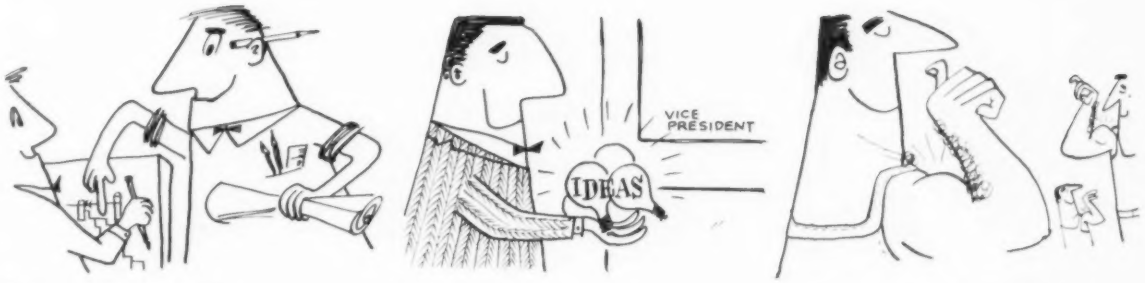
2 Getting Along with Others

We found everyone we spoke to clearly aware of the importance of harmonious working relationships. Oil, like so much of U.S. industry, is fast becoming "human relations" conscious. Management is trying to instill in supervisors a greater sensitivity to human behavior by bringing instruction in human relations into the firm, and by other methods. But so far these efforts have been usually aimed at selected people already well up in management. Very little instruction reaches the fellow further down.

The people who answered our mail survey put "getting along with others" in first place, and its importance was stressed by all those we interviewed as well. In the latter group, some held the sharply realistic view that "the more acceptable a man's personality, the more acceptable his ideas." But others warned against being so eager to please that one's ideas become not worth considering. What is needed, they agreed, is to strike a balance.

But no one doubted that getting along with other people is of great importance in a man's career. For one thing, people depend more on each other in a business organization today than before. This was recognized by several researchers, who said "Research today is a matter of working in groups." It might also be said of operations. Realization of this fact has been growing among businessmen, as has been noticed by academic observers such as David Riesman. He sees a trend in U. S. business life in which the primary concern for production is being replaced by concern for people. Riesman believes this is partly a result of industry's ability now to satisfy most physical wants. The danger in this concern for people, he feels, is that it is sometimes used to find ways of manipulating people rather than bringing a new respect for individuality into business life.

Technical Man (Besides Ability)?



3 Supervisory Skill

An important avenue for rapid advancement in the oil industry is management. And for the manager—frequently the technically trained person in this industry—skill in supervision is a critical matter. But the engineer or scientist is likely to face some special problems when he leaves the work for which his education has prepared him, and becomes a supervisor. An interesting analysis of these problems and of the career choices open to the technical man was made by Harold Mangelsdorf, chairman of the Advisory Committee on Human Relations of Standard Oil Co. (N. J.)

He divides the technically trained men in the oil industry into three groups: (1) those who don't want to travel up the supervisory ladder, (2) those who want to from the start and acquire their technical training as a means of assisting their management careers, and (3) people who may start along the technical path but who later change their minds and decide to take the opportunities to enter management.

The fellow who changes horses may find himself at a disadvantage because his training has been strictly technical. But most companies offer him many opportunities to learn about management, and he should take them. He can learn from hearing discussions of corporate problems, labor relations, marketing, etc.

But the most important thing a management man has to learn is how to get work done through others. And there are no handy guides to teach him. Moreover, there is no ideal personality type for a supervisor; a good one can be cut from a variety of cloths, Mr. Mangelsdorf believes. It's up to the neophyte to find the "style" that suits him best. He can sometimes learn the best methods of getting results by observing experienced managers.

4 Salesmanship

We've noticed that the engineer or scientist often feels squeamish about the notion that a person needs to "sell" his ideas. His superiors should spot the good ones and adopt them without urging, they feel. No doubt this is often what happens. But anyone who is realistic knows that even the best ideas have at times lost out against someone's poor judgement, envy, or plain inertia.

Harold Mangelsdorf, whose views we've summarized in the previous column, says that salesmanship is perhaps the special non-technical problem of the man who elects to remain in technical work rather than move into management. Once he is convinced that he has a worth-while idea, he should consider how he can persuade others of its value. He must know the idea inside and out—its salability, the company's need for it, its cost, etc. And he must know when and how to present it.

Another executive observed that it takes salesmanship (as well as a good idea) to turn a researcher's work into something more tangible than a report.

This isn't an argument for turning the technical man into a huckster. But here is another area in which practical success depends on skills not developed in a technical education.

"Self-Development" Is the Key

How do you stand with the points discussed here? Are you being held back by shortcomings in these areas? We are going to help. In coming months we will have articles on writing, speaking before groups, reading efficiency, health, and other topics. They will be tools for self-development, to help you move ahead in your profession.

5 A Concern for Health

Our mail survey made it clear that oilmen attached much importance to health. They were aware of the threat poor health can be to a person's career, and there was no feeling that a serious interest in health by the ambitious man was misdirected energy. Summing up the views of the men we interviewed, Mr. Scheuman of Cities Service had this to say:

"A man in his early 50s is assumed to be at the peak of his career. As long as an individual's health is good, he can continue his useful service for a number of years. But a heart condition or some other illness that is unforeseeable may make it mandatory to give him less responsible work, to shunt him aside. This is something to which most men give very little thought when they are young."

But it is when they are young—or younger—that the trouble may begin, believes a growing part of the medical profession. A recent study by an organization known as Life Extension Examiners suggests that it is generally in the 30 to 40-year-old group of executives that heart abnormalities, high blood pressure and other ailments first show up. These conclusions came from a study of 1400 executives of all ages.

The organization blames the common practice today of introducing younger men into management, pushing them ahead faster than before. The older executives, LEE believes, were given their responsibilities more gradually so that less tension was created at each new step up.

Despite this, management is also taking a greater interest in the health of employes, as the trend toward compulsory, company supported medical examinations shows.

Any program for better health—whether a company's or an individual's—is identical to a preventive maintenance program for equipment.

Proposing in a 'Meeting-in-Print' . . .

A New Crude Oil Quality Index

Agree or Disagree? Join this "Meeting-in-Print"

As a technical man, you've probably had the frequent pleasure of participating in open discussions after the presentation of a paper at a technical society meeting.

Here's your chance to do it in print. Just as in the technical meeting, the ideas and opinions expressed in this article are these of the author (the speaker). We as editors (chairman of the meeting) have presented here:

1—the author's own paper, 2—a prepared discussion of this paper (see p. 000), and 3—a reply by the author (see p. 000).

Because there will undoubtedly be further questions and comments from "the floor," we invite you to send those comments to The Editor, PETROLEUM PROCESSING.

By DAVID ROTHBARD

IN DEVELOPING the new crude oil Quality Index (QI) proposed here, it was considered necessary that the various crude fractions be evaluated by a single numerical figure. These quality figures for the various crude cuts (gasoline, kerosine, diesel fuel, gas oil, lube oil and heavier) can then be combined into one single number.

Basis of Quality Index

For the five fractions distilled from the crude oil, the most significant test measuring the quality of each cut is used, together with the yield of the fraction. These are combined to give:

$$Rx = (T/BP)(AV)(Y)$$

where:

Rx = the quality rating of the crude fraction.

x = crude fraction designation, with $x = 1$ for gasoline, $x = 2$ for kerosine, $x = 3$ for diesel fuel, $x = 4$ for gas oil, and $x = 5$ for lube oils and heavier.

AV = Assigned Value for each fraction, generally called product weight. Table 1.

Y = yield of the fraction, %.

T = significant test involved in the fraction, Figs. 1-5.

BP = base point or midpoint of the test, from Table 1.

(T/BP) = percentage of the midpoint, called test relative.

From the above fractional quality ratings, the over-all crude Quality Index is derived as a summation:

$$QI = R_1 + R_2 + R_3 + R_4 + R_5$$

The significant tests (T in first equation) used, and their base points (BP) are shown in Table 1. The base points of these tests were obtained by taking midpoints of the estimated maximum and minimum test values by which each of the fractions are characterized, as shown in Table 2.

Using the Quality Index

Actually performing the tests listed in Tables 1 and 2 would require a well-manned and expensively equipped testing laboratory. Therefore, it seemed desirable to find some simple test, such as API gravity, which could be used to estimate the values for the significant tests (T).

Such a simple relationship between the API gravity of specific fractions and properties such as smoke point, diesel index, characterization factor and viscosity index, is furnished in a tabulation by W. L. Nelson.[14]

There was not, however, a gravity-octane relationship for gasoline. It was, therefore, necessary to collect data on API gravities and octane numbers in order to develop a conversion chart for estimating octane numbers for the gasoline fraction value of T.

Because of the limited amount of data available to the author, this gravity-octane chart lacks the precision desired by the author, and it is hoped that the readers of this article will be encouraged to send additional gravity-octane data to the author.

Fig. 1 for gravity-octane conversion was based on data found in the literature, and shows a great deal of scattering of the points. Based on present information, the straight line drawn in this chart seems to represent the majority of points.

Fig. 2 for gravity-smoke point conversions in the kerosine range was taken from W. L. Nelson's tabulation,[14,15] as were Fig 3 for gravity-diesel index conversions in the diesel oil range, and Fig. 4 for gravity-characterization factor conversions in the gas oil range.

Fig. 5 for gravity-viscosity index conversion in the lube oil and heavier range covers both positive and negative values. For API gravities lower than 14.5, a straight line connecting the last three points was drawn.

The QI was used (with the con-

Table 1—Significant Tests Used in Quality Index Calculations

Crude Fraction	Significant Test	Base Point (BP)	Assigned Values (AV)
Gasoline	Octane No. MM (Clear)	42.5	40
Kerosine	Smoke Point	30.0	10
Diesel Fuel	Diesel Index	50.0	20
Gas Oil	Characterization Factor	11.7	10
Lube Oil	Viscosity Index	22.0	20

Table 2—Maximum & Minimum Values of Significant Tests Used for Quality Index

Fraction	Significant Test	Max. Value	Min. Value	Midpoint
Gasoline	Octane No. MM (Clear)	80	5	42.5
Kerosine	Smoke Point	45	15	30.0
Diesel Fuel	Diesel Index	79	20	50.0
Gas Oil	Characterization Factor	12.9	10.5	11.7
Lube Oil	Viscosity Index	113	—70	22.0

Why Is a New Crude Oil Quality Index Needed?

REFINERS have long felt the need for some rapid, but accurate, means of determining the quality of a crude oil before actually using it.

API gravity has gained prominence as a basis for crude oil pricing, [1,8] because there appears to be a fair correlation between the gravity of a crude and the gasoline yield.[13,17]

Although many other crude oil quality specifications have been developed—API gravity continues to be the determining factor in the price structure of crude oil.

Discrepancies in gasoline yields indicated by API gravity [12,21] actually make this a poor basis for current price structures. Of 34 crudes in five API ranges [1,4] (35.0-35.9°; 36.0-36.9°; 37.0-37.9°; 38.0-38.9°; and 39.0-39.9° API), actual gasoline yields within the groups had variations from 15.8 to 23.1% (respective variations were 17.6 for 5 crudes, 20.1 for 7 crudes, 23.1 for 7 crudes, 15.8 for 8 crudes, and 18.2 for 7 crudes).

A partial solution is found in H. M. Smith's correlation index,[18] which measures crude oil quality using close fractions (25°C cuts) from Hempel distillations. The index relates average boiling points and specific gravity of specific cuts from the crude, and is useful for finding the paraffinicity of individual fractions. However, this index has limited use; it is time consuming, does not apply to the residual fraction of the crude, and involves extrapolating boiling points from vacuum to atmospheric values.

Viscosity gravity constant[6] measures paraffinicity of lube oil fractions, including the residuals, but does not apply to heavy and light fuels.

The lack of a simple, accurate system of rating quality of crude oils led the author to develop the crude oil Quality Index in this article.

Readers are invited to send their comments and criticisms to The Editor, PETROLEUM PROCESSING.

version Fig. 1-5) for 96 crudes representing a variety of sources, qualities, dates at which the distillation was done, and different distillation methods for getting the fractions.

Table 3 gives the different properties and *QI* calculations for the 96 crudes, and classifies the crudes into Grade categories based upon their *QI*:

Crude Grade	*QI* Number Range
A	50 or higher
B	40 to 49
C	30 to 39
D	20 to 29
E	10 to 19
F	0 to 9
G	−10 to −1
H	−20 to −11
I	−30 to −21
J	lower than −30

Most of the crude data in Table 3 was for four fractions, not including the diesel fraction. Only eleven crudes had data for all five fractions. However, this omission did not affect the value of *QI*, as the diesel fuel fraction was partly absorbed by the kerosine fraction, and partly by the gas oil.

An example of this is shown by the two Conroe crudes (Nos. 18 and

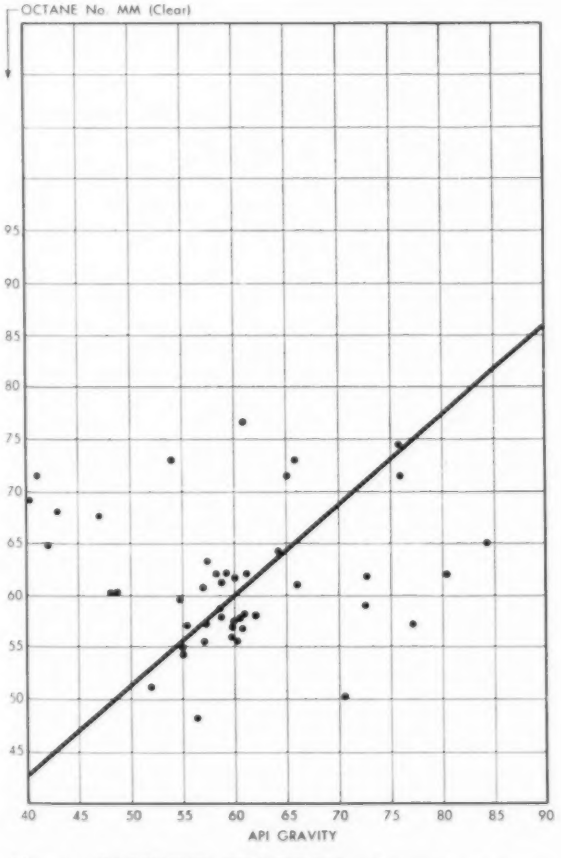


Fig. 1—**GASOLINE FRACTION** relationship between °API gravity and Octane number MM Clear).

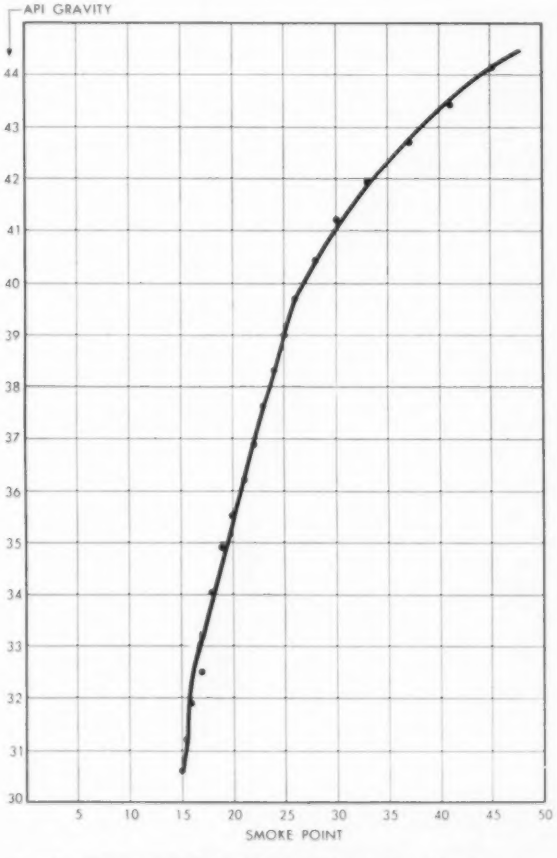


Fig. 2—**KEROSINE FRACTION** relationship between °API gravity and Smoke Point, °F.

■ Crude Oil Quality Index

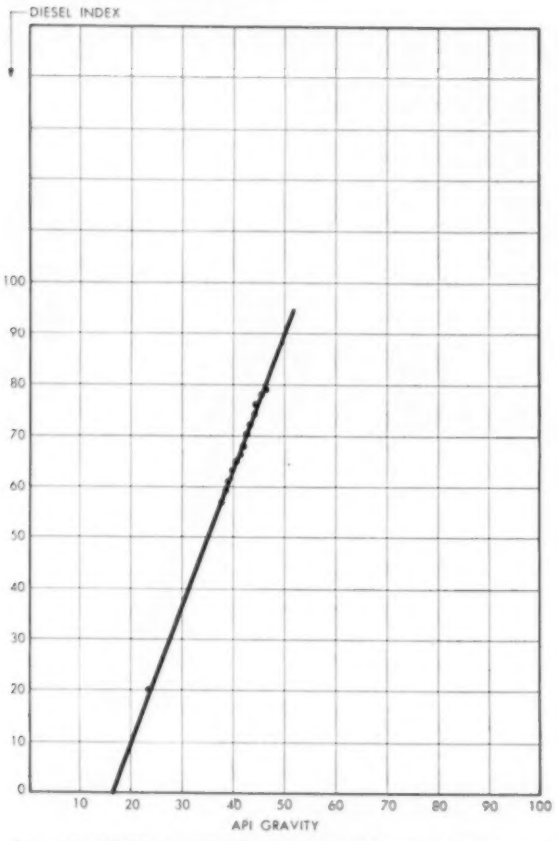


Fig. 3—**DIESEL FUEL FRACTION** relationship between °API gravity and Diesel Index.

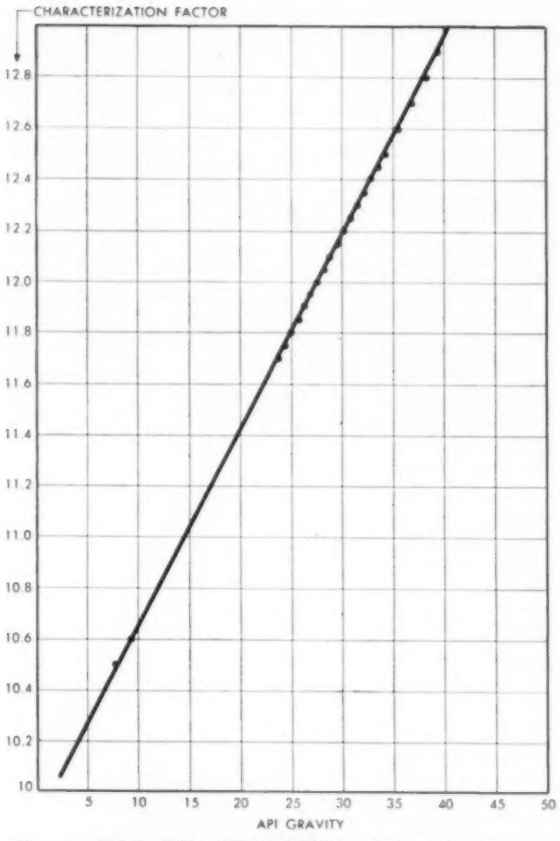


Fig. 4—**GAS OIL FRACTION** relationship between °API gravity and Characterization Factor.

19), where No. 18 had data for five fractions, giving a *QI* of 20, and No. 19 had data for four fractions, also giving a *QI* of 20. The difference in gasoline ratings reflects different fractionation efficiencies, with No. 19 being conducted in a commercial crude unit; a laboratory still was used for No. 18.

As a check on Fig. 1; Fig. 6 relates the *QI* calculated using Fig 1 versus the *QI* calculated using known gasoline octane ratings for 26 crudes. The points plotted in Fig. 6 agree well with the straight line, giving a ratio of 1.1/1 for *QI* from actual octanes/*QI* from chart octanes. In turn, this indicates that it is possible to use the *QI* relationship when the gasoline octane (but not the API gravity) is known, or to approximate the gasoline API gravity from a known octane rating.

Quality differences from the *QI* evaluation are clearly illustrated by comparing Bradford crude (No. 12) with Rodessa crude (No. 73). Though the gasoline yields are very nearly the same for these two crudes, the lube oil fraction qualities vary widely. In fact, it is the 32.5 lube oil rating of Bradford crude (compared to 24.2 for Rodessa) that gives the Bradford crude most of its *QI* rating of 56 versus 47 for Rodessa.

Reproducibility of the *QI* test can be shown by the similarity of ratings based on data for the same crude, but from different literature sources. There were eight producing areas or duplicates represented by 16 different crudes. Of the eight duplicates, five fall in the same *QI* grade, and the remaining three (East Texas, Oklahoma City, and Kettleman Hills) have differences of 9, 11, and 14 in *QI* ratings. The *QI*'s of the other five duplicates varied 1-5 points.

Quality Index Versus API

When crudes are arranged according to their API gravities, using the gravity range system upon which the price structure of crude oil is based, a wide variation of *QI*'s within each API gravity grouping can be seen.

The first API grouping (above 40° API gravity), with 28 crudes, shows a maximum *QI* of 58 and a minimum *QI* of 19, giving a spread of 39 *QI* units and covering 5 different *QI* grade categories in the group's spread.

The second through the sixth API groupings (39.0-39.9°; 38.0-38.9°; 37.0-37.9°; 36.0-36.9°; 35.0-35.9° API) show a maximum *QI* variation of 41 units and a minimum *QI* variation of 24 within groupings. These show the inadequacy of the current API gravity basis for the crude oil price structure, leading to the conclusion that use of the *QI* would be of great help to both buyer and seller in judging crude oil quality.

Example of QI Calculation

East Texas crude (number 25 in Table 3) is used for the following example of how to calculate *QI:*

Fraction	Yield, %	°API Gravity
Gasoline	38.0	60.5
Kerosine	10.0	39.0
Diesel Fuel	10.0	36.5
Gas Oil	9.5	32.0
Lube Oil	32.5	19.3

Using the basic equation of: $Rx = (T/BP)(AV)(Y)$, where for the various fractions, the variables and ratings (Rx) with values of T from Figs. 1-5) are:

Fraction	T	B	AV	Y	R_x
Gasoline	60.5	42.5	40	38.0	21.6
Kerosine	43.1	30.0	10	10.0	1.4
Diesel Fuel	53.0	50.0	20	10.0	2.1
Gas Oil	12.35	11.7	10	9.5	1.0
Lube Oil	20	22	20	32.5	5.9

The over-all crude *QI* is then obtained by:

$QI = Rx = + R_1 + R_2 + R_3 + R_4 + R_5$
$= 21.6 + 1.4 + 2.1 + 1.0 + 5.9 = 32$

Note that the Quality Index value is rounded to eliminate decimals.

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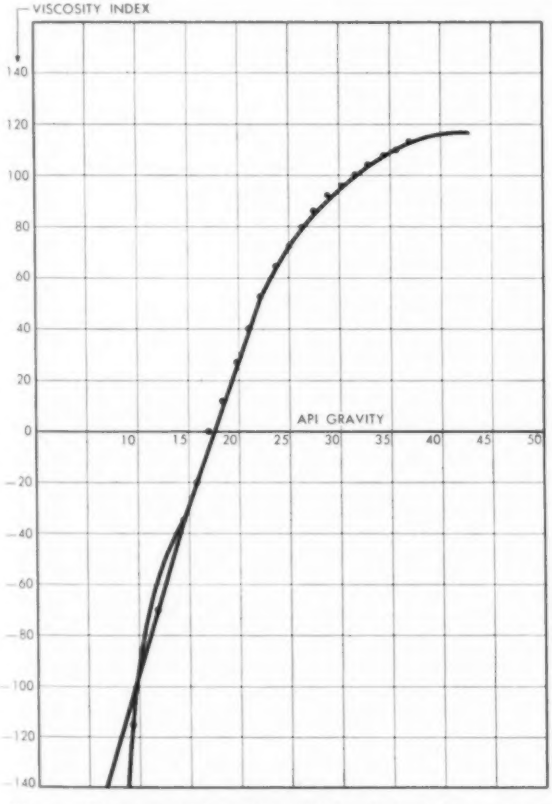


Fig. 5—**LUBE OIL FRACTION** relationship between °API gravity and Viscosity Index.

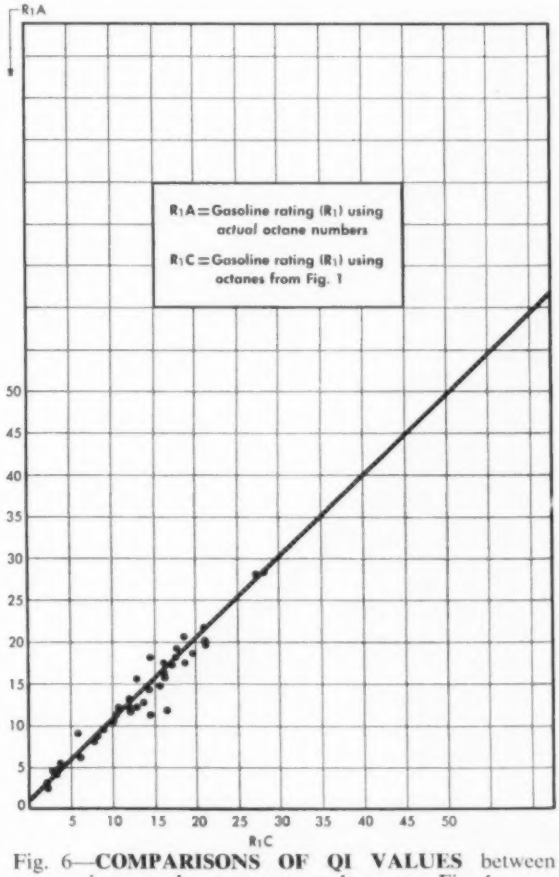


Fig. 6—**COMPARISONS OF QI VALUES** between using actual octane test results versus Fig. 1.

Please turn page for more on the Crude Oil Quality Index. . . .

Table 3—Quality Index Calculations for 96 Crude Oils from Around the World

Source of Crude	Reference	Gasoline Yield	Gasoline °API	Gasoline R_s	Kerosine Yield	Kerosine °API	Kerosine R_s	Diesel Fuel Yield	Diesel Fuel °API	Diesel Fuel R_s	Gas Oil Yield	Gas Oil °API	Gas Oil R_s	Lube Oil Yield	Lube Oil °API	Lube Oil R_s	Class Crude QI	Class Crude	Class Crude °API
1—Abqaiq, Saudi Arabia	(4)	32.7		10.0*	10.9	43.1	1.4				38.5	35.3	4.1	16.7	23.8	9.9	25	D	36.5
2—Abqaiq "D" Member, Saudi Arabia	(4)	33.1		12.1*	11.3	44.4	1.9				39.3	35.3	4.2	13.5	23.9	8.0	26	D	36.8
3—Agua Dulce, Texas	(4)	22.5	57.7	12.1	19.5	38.0	1.5				51.5	31.0	5.4	5.0	13.2	−2.1	17	E	39.3
4—Ain Dar, Saudi Arabia	(4)	28.9		8.9*	10.3	43.8	1.5				37.5	34.9	4.0	21.5	22.5	10.9	25	D	34.1
5—Antioch, Southwest Field, Okla.	(9)	34.6	62.9	20.3	17.1	42.8	2.2				8.1	36.0	0.9	37.6	25.8	26.1	50	A	42.1
6—Arabian	(4)	26.0	60.1	14.6	19.0	44.4	3.0	11.0	35.7	2.2	34.5	26.5	3.5	8.8	7.0	−10.7	13	E	34.5
7—Armstrong Field, Logan Cty., Colo.	(23)	9.4	54.9	4.9	2.4	42.3	0.3				14.8	32.8	1.6	72.6	7.9	−81.3	−74	J	15.6
8—Badarpur Field, India	(18)	16.0	46.5	7.3							47.6	22.3	4.7	36.4	8.3	−39.0	−27	I	18.7
9—Barataria, La.	(4)	16.5	57.8	9.0	15.5	42.0	1.7				51.5	31.7	5.4	15.0	19.0	2.3	18	E	36.0
10—Bemis-Shutts, Composite, Kans.	(7)	25.8	61.0	14.8	16.1	40.7	1.6				9.2	33.5	1.0	48.3	19.5	10.1	28	D	33.5
11—Bonanza Field, Big Horn Cty., Wyo.	(25)	36.1	60.5	20.5	5.8	41.5	0.6				21.5	32.8	2.3	35.7	18.3	2.6	26	D	35.8
12—Bradford Field, Penna.	(18)	32.7	63.7	19.2	16.3	45.2	2.7				8.8	38.2	1.0	39.0	29.2	32.5	56	A	44.7
13—Burbank, Okla.	(7)	29.9	58.9	16.5	17.5	41.7	1.9				10.8	34.6	1.2	40.6	28.3	32.5	52	A	38.4
14—Burbank Field, Okla.	(9)	24.3	55.7	12.9	11.5	42.6	1.4				16.5	36.6	1.8	47.0	27.6	36.8	53	A	35.8
15—Campbell Field, Alberta, Canada	(22)	29.3	56.2	15.6	5.1	42.1	0.6				19.3	35.6	2.1	45.0	19.4	8.6	27	D	33.0
16—Cephas, Kans.	(7)	30.4	59.5	17.0	17.1	41.0	1.7				10.3	34.5	1.1	51.3	24.4	31.9	52	A	38.4
17—Charenton, La.	(4)	13.0	48.0	6.1	24.5	40.6	2.3				53.0	33.2	5.6	8.0	19.4	1.5	16	E	36.9
18—Conroe, Texas	(4)	25.5	52.4	12.8	25.5	38.4	2.1	22.0	32.7	3.8	24.5	29.0	2.5	2.3	12.7	−1.2	20	D	36.5
19—Conroe, Texas	(4)	31.0	48.7	14.6	21.0	35.8	1.4				40.5	30.3	4.2	6.0	16.8	−0.4	20	D	37.3
20—Cotton Valley Field, La.	(18)	41.9	68.1	26.5	18.0	49.5	30.				11.9	40.6	1.3	25.3	31.1	22.8	54	A	50.9
21—Davis Ranch Field, Wabaunsee Cty., Kans.	(21)	16.4	63.1	9.7	16.3	46.3	2.7				12.5	37.6	1.4	54.4	15.9	−9.9	4	F	29.1
22—Davis Ranch Field, Wabaunsee Cty., Kans.	(7)	15.0	63.0	8.8	14.9	46.2	2.5				13.0	37.1	1.4	56.1	16.9	−4.1	9	F	28.1
23—Dermott Field, Scurry Cty., Texas	(20)	46.5	64.8	28.2	9.6	41.3	1.0				12.6	35.2	1.4	27.2	23.3	15.1	46	B	46.3
24—Eastern Venezuela	(4)	27.0	62.0	15.8	10.0	39.0	0.8	11.0	34.0	2.1	9.5	30.0	1.0	42.5	20.0	10.8	30	C	32.2
25—East Texas, Texas	(4)	38.0	60.5	21.6	10.0	39.0	0.8	10.0	36.5	2.2	9.5	32.0	1.0	32.5	19.3	5.9	32	C	38.1
26—East Texas, Texas	(4)	26.8	65.0	16.2	22.2	42.0	2.9				34.5	32.2	3.6	15.0	16.5	−1.6	21	D	37.6
27—Edmond, West Field, Okla.	(9)	33.4	61.5	19.2	10.5	43.2	1.4				14.9	36.8	1.6	39.1	25.5	23.3	46	B	41.5
28—Edmond, West Field, Okla.	(7)	36.8	62.4	21.5	16.0	42.4	1.9				10.1	35.4	1.1	36.2	23.9	21.4	46	B	42.5
29—Elk City Field, Okla.	(7)	55.5	63.9	33.1	15.7	41.2	1.6				6.2	34.5	0.7	20.8	29.3	17.4	53	A	50.1
30—Feltis Northwest, Kansas	(7)	38.9	64.0	23.3	16.1	42.4	1.9				7.8	35.5	0.8	35.2	22.6	18.2	44	B	42.4
31—Floris, Okla.	(7)	31.5	60.8	17.8	14.0	41.0	1.4				6.7	35.9	0.7	47.8	28.0	37.7	58	A	39.4
32—Glapwell Pit, England	(18)	0.5	58.2	0.3	7.8	49.9	1.3				8.8	43.8	1.1	81.9	28.9	67.6	70	A	30.6
33—Golden Trend, Composite, Okla.	(7)	40.3	62.1	23.4	9.3	43.2	1.2				10.3	35.8	1.1	39.6	26.4	28.4	54	A	41.9
34—Heavy McFaddin, Tex.	(4)	9.0	42.0	3.8	21.5	30.8	1.1				53.0	23.7	5.3	15.0	12.1	−8.0	2	F	25.7
35—Heavy Refugio, Tex.	(4)	7.2	40.2	2.9	20.2	32.8	1.1				53.0	22.0	5.2	18.0	12.4	−9.3	0	F	23.6
36—Heavy Saxet, Tex.	(4)	7.5	47.0	3.4	25.8	32.0	1.4				53.0	28.6	5.5	12.2	10.9	−8.6	2	F	25.6
37—Hendrick Field, Tex.	(18)	22.7	57.7	12.5	5.6	41.1	0.6				18.4	32.7	2.0	52.0	17.7	9.5	25	D	30.0
38—Huntsman Field, Cheyenne Cty., Neb.	(23)	27.1	62.1	15.7	14.9	42.6	1.8				9.5	36.2	1.0	45.5	23.9	26.8	45	B	38.4
39—Iran	(4)	29.0	59.9	16.3	10.0	35.7	0.7	8.0	32.5	1.6	10.0	27.0	1.0	39.4	13.4	−16.5	3	F	32.8
40—Jelinek, Kansas	(7)	12.2	50.6	5.9	15.8	37.3	1.2				3.5	31.4	0.4	66.5	19.4	12.4	20	D	24.2
41—Kettleman, Calif.	(4)	48.2		25.4	6.0	39.1	0.8				32.4	33.2	3.5	17.0	23.2	8.8	38	C	37.5
42—Kettleman Hills, Calif.	(18)	39.0	58.9	21.7	4.1	41.9	0.4				18.7	36.0	2.0	35.9	19.0	5.2	29	D	37.8
43—Kilgore Field, Tex.	(18)	36.0	61.0	20.6	9.1	41.7	1.0				15.3	35.2	1.7	38.4	21.6	16.7	40	B	40.0
44—K.M.A. Field, Tex.	(18)	40.8	62.3	23.8	10.7	42.6	1.3				13.4	35.2	1.4	30.8	23.6	17.9	44	B	43.8
45—Kuwait	(4)	24.5	73.3	16.5	15.5	45.3	2.5	10.0	35.8	2.1	31.9	23.0	3.2	18.0	5.5	−25.2	−1	G	7.4
46—LaFitte, La.	(4)	17.0	55.0	8.9	18.5	41.7	2.0				53.0	31.8	5.6	10.0	18.0	0.4	17	E	36.3
47—Leduc Field, Alberta, Canada	(10)	36.0	59.5	20.2	9.6	41.7	1.0				16.0	35.6	1.7	34.4	22.9	18.4	41	B	40.9
48—Liberal Light, Kans.	(7)	33.7	61.5	19.4	11.3	42.5	1.4				9.3	36.8	1.0	43.7	26.9	32.6	54	A	41.7
49—Light McFadden, Tex.	(4)	19.5	57.0	10.5	16.5	37.3	1.2				52.0	28.3	5.4	10.5	12.8	−5.0	12	E	34.7
50—Light Refugio, Tex.	(4)	24.0	60.7	13.7	18.0	36.1	1.3				46.5	27.0	4.7	10.0	10.9	−7.1	13	E	34.8
51—Loma Novia, Tex.	(4)	14.0	41.0	5.7	21.5	30.8	1.1				53.0	22.6	5.3	10.0	12.0	−5.5	7	F	24.4
52—Long Beach Field, Calif.	(12)	20.8	53.8	10.7							31.2	32.7	3.3	48.0	11.6	−27.8	−14	H	25.1
53—Manila Village, La.	(4)	22.5	61.4	13.0	26.5	41.7	2.9				40.5	28.0	4.2	9.0	17.0	−0.5	20	D	38.3
54—Meadow Creek, Johnson Cty., Wyo.	(24)	34.7	58.9	19.2	15.6	42.5	1.9				12.5	36.3	1.4	17.9	26.5	13.0	36	C	41.9
55—Midway Field, Ark.	(2)	29.5	62.5	17.2	9.3	43.4	1.3				26.2	31.8	2.8	33.3	16.2	−4.5	17	E	35.5
56—Mirando, Tex.	(4)	4.3	37.0	1.7	27.2	29.3	1.3				53.0	22.2	5.2	14.0	12.8	−6.5	2	F	21.4
57—Mt. Vernon, Okla.	(7)	37.3	61.8	21.6	16.1	40.7	1.6				9.6	34.5	1.0	35.4	22.5	18.7	43	B	40.1
58—Near East (Wafra)	(4)	13.1	64.8	7.9	12.6	41.8	1.4	4.3	34.1	0.8	37.2	25.2	3.8	32.3	6.6	−35.5	−22	I	24.5
59—New Castle, Okla.	(7)	35.2	62.5	20.6	14.5	42.8	1.8				10.5	35.0	1.1	39.0	25.1	25.6	49	B	40.6
60—Norton, Kans.	(7)	25.3	61.8	14.7	13.2	40.6	1.3				8.3	33.6	0.9	53.2	18.0	2.4	19	E	30.5
61—North Hammer Field, Barton Cty., Kans.	(21)	31.1	61.3	17.8	18.4	43.0	2.5				11.0	36.4	1.2	39.4	23.3	21.8	43	B	38.2
62—North Hoover Field, Garvin Cty., Okla.	(22)	54.0	62.6	31.6	10.6	40.6	1.0				10.0	36.2	1.1	24.3	20.3	6.9	41	B	45.6

Table 3 (continued)

Source of Crude	Reference	Gasoline Yield	Gasoline °API	Gasoline R_1	Kerosine Yield	Kerosine °API	Kerosine R_2	Diesel Fuel Yield	Diesel Fuel °API	Diesel Fuel R_3	Gas Oil Yield	Gas Oil °API	Gas Oil R_4	Lube Oil Yield	Lube Oil °API	Lube Oil R_5	Class QI	Class Crude	Crude °API
63—North Lindsay Field, McClain Cty., Okla.	(22)	45.0	60.0	25.4	11.5	44.1	1.7	...	...	...	15.5	37.6	1.7	27.9	29.0	23.1	52	A	44.7
64—North Synder, Scurry Cty., Tex.	(20)	36.7	60.5	21.0	10.2	41.9	1.1	...	...	...	14.9	35.4	1.6	36.4	22.7	19.2	43	B	39.8
65—North Withers, Tex.	(4)	7.5	43.0	3.2	23.0	31.5	1.2	...	...	...	53.0	23.5	5.3	15.0	18.0	0.5	10	E	25.6
66—Oklahoma City, Okla.	(9)	26.9	61.0	15.4	10.1	44.1	1.5	...	...	...	13.7	37.4	1.5	48.1	31.0	42.9	61	A	37.8
67—Oklahoma City Field, Okla.	(18)	26.2	60.0	14.8	17.6	43.2	2.3	...	...	...	10.1	35.8	1.1	45.0	25.9	28.8	47	B	38.0
68—Pakanbaroc Region, Sumatra	(4)	18.6	...	7.3*	6.5	44.6	1.1	...	...	...	35.5	39.5	3.9	37.6	29.7	32.2	44	B	35.8
69—Pembrook Field, Upton Cty., Tex.	(11)	31.6	59.2	17.7	4.3	42.3	0.5	...	...	...	16.2	37.0	1.8	44.6	21.9	20.3	40	B	36.8
70—Pettus Wilcox, Tex.	(4)	23.3	55.0	12.2	20.7	38.8	1.7	...	...	...	48.5	30.6	5.1	6.0	12.5	–3.0	16	E	38.5
71—Pioneer Field, Okla.	(18)	16.3	46.3	7.4	...	...	..	...	...	...	32.1	36.8	3.5	50.6	23.3	28.0	39	C	31.3
72—Plymouth Field, Tex.	(18)	40.7	56.4	21.8	7.9	42.1	1.1	...	...	...	29.8	33.4	3.2	20.5	18.7	2.6	29	D	39.0
73—Rodessa Field, La.	(18)	32.1	60.2	18.1	20.0	47.2	3.3	...	...	...	11.9	39.0	1.3	34.4	29.0	24.2	47	B	43.6
74—San Joaquin, Calif.	(4)	30.8	64.3	18.6	16.3	41.3	1.7	17.0	34.4	3.3	29.0	32.3	3.1	6.3	18.9	0.9	28	D	41.0
75—Scurry County, Tex.	(4)	34.8	66.0	21.3	14.2	39.0	1.2	...	...	...	39.5	28.3	4.1	10.0	17.0	–0.5	26	D	43.0
76—Seelywick, Kans.	(7)	35.8	63.4	21.1	16.0	42.3	1.9	...	...	...	9.6	33.8	1.0	35.9	26.8	26.4	50	A	41.6
77—Seeligson, Tex.	(4)	24.0	51.9	12.0	34.0	42.8	4.2	24.5	34.4	4.6	14.6	25.8	1.5	2.6	11.3	–1.6	21	D	39.9
78—Seminole, Okla.	(7)	39.1	60.2	22.1	19.1	40.9	1.9	...	...	...	7.3	34.1	0.8	34.0	23.5	19.2	44	B	40.6
79—Sharron Ridge, Scurry Cty., Tex.	(20)	42.2	62.1	24.5	4.7	42.6	0.6	...	...	...	18.0	36.6	2.1	28.6	24.7	18.5	46	B	45.4
80—Southeast, Red Spring, Okla.	(7)	30.5	62.0	17.7	14.7	41.8	1.6	...	...	...	11.0	34.0	1.1	41.7	20.9	14.4	35	C	37.3
81—South Mayville, Garvin Cty., Okla.	(22)	43.3	64.5	26.4	15.5	42.8	1.9	...	...	...	8.4	35.6	0.9	39.2	26.7	28.8	58	A	45.2
82—Spindle Top Field, Tex.	(18)	14.6	55.7	7.8	...	...	...	...	...	...	38.2	30.2	4.0	45.5	20.0	12.1	24	D	28.9
83—Sprayberry (Deep) Field, Dawson Cty., Tex.	(11)	36.1	58.7	20.0	4.8	41.3	0.5	...	...	...	17.4	36.2	1.9	40.7	20.8	13.7	36	C	37.2
84—Stettler Field, Alberta, Can.	(10)	24.6	60.8	14.1	4.1	41.5	0.4	...	...	...	16.5	34.4	1.8	52.3	15.9	–3.3	13	E	30.2
85—Sumatra, North	(4)	68.0	56.5	36.5	12.0	41.2	1.2	8.0	35.0	1.6	...	...	..	12.0	21.4	4.8	44	B	47.8
86—Sussex Field, Johnson City., Wyo.	(5)	30.3	60.5	17.2	11.3	43.2	1.5	...	...	...	14.5	36.3	1.6	40.8	23.4	23.0	43	B	39.2
87—Sweden, Tex.	(4)	26.9	57.0	14.5	20.1	40.0	1.8	...	...	...	46.5	32.1	4.9	5.0	12.7	–2.4	19	E	40.0
88—Synthetic Substitute for Crude	(18)	62.2	73.9	42.1	18.5	54.9	3.2	...	...	...	13.0	47.2	1.6	3.0	35.8	3.4	50	A	56.5
89—Tex Harvey Field, Midland Cty., Tex.	(11)	39.1	59.7	21.9	4.3	41.7	0.5	...	...	...	16.2	36.4	1.8	39.3	21.7	17.5	42	B	38.4
90—TXL, Ector Co., Tex. PP, June 1950	(19)	31.0	66.7	19.2	19.7	46.5	3.4	...	...	...	14.0	38.0	1.5	35.2	22.1	16.9	41	B	40.9
91—Venice, La.	(4)	18.5	58.8	10.2	24.5	42.1	2.8	...	...	...	38.5	30.6	4.1	17.0	16.4	–2.2	15	E	35.1
92—Volkland, Kans.	(7)	51.1	67.6	32.0	15.2	41.8	1.7	...	...	...	6.2	35.8	0.7	25.5	21.9	11.6	46	B	48.8
93—West Cement, Okla.	(7)	25.1	53.6	12.8	20.2	42.9	2.8	...	...	...	7.0	36.9	0.8	47.4	25.8	32.6	49	B	37.5
94—West Kansas	(7)	30.9	60.7	17.6	17.7	41.3	1.8	...	...	...	9.5	34.3	1.0	41.2	20.2	11.2	32	C	36.4
95—West Texas	(4)	33.5	55.3	17.7	8.5	39.5	0.7	8.5	33.3	1.6	11.0	29.0	1.1	38.5	17.8	1.1	22	D	32.4
96—Yenter Field, Logan Cty., Colo.	(23)	34.8	57.4	18.7	10.4	42.3	1.2	...	...	...	16.2	36.2	1.8	36.3	23.3	20.1	42	B	39.2

*Estimated from R_1A using conversion factor of 1.1.

A Prepared Discussion*

IN GENERAL we agree with the inadequacy of the API gravity method for correlating the relative qualities of crude oil, and we recognize that the basic idea of the author is a good one. However, we do not feel that the proposed method would be too reliable.

As the author shows, there can be great variation in gasoline yields, lubricating oil yield, and in the quality of the fractions from crudes of a given °API gravity.

The author's approach of breaking the crude into five fractions, which comprise the major marketed products seems logical. The basic idea of giving additional credit to each of the fractions, based on their respective quality characteristic, is also good.

However, we doubt that the proposed method contributes a useful improvement by inclusion of the quality ratings for each of the crude oil fractions because of the technical problems in evaluating these qualities:

1—Fig. 1, relating API gravity and octane for gasoline, has such a scattering of points, that statistics probably would show no significant correlation. Generally, for a given crude, the lower the gasoline fraction boiling point, the higher the octane. Or for gasolines of the same boiling point from different crudes, those with lower API gravities generally have higher octanes.

2—For Figs. 3 and 4 (Diesel Index and Characterization Factor) are also dependent on the boiling points of the fractions, and Viscosity Index (Fig. 5) depends on both boiling point and chemical composition variables.

3—An even more serious criticism is the mathematical balance used in the rating formula where the value of each fraction is assumed directly proportional to its quality specification. It would be far more correct to assume that all gasolines have the same values than to assume that a gasoline of 60 octane is worth 50% more than a gasoline of 40 octane. Also, assuming the value

*This article was reviewed in detail, before publication, by a qualified representative of a large East Coast oil company, the name of which PETROLEUM PROCESSING is not at liberty to reveal.

of kerosines proportional to smoke point value and the value of diesel fuel proportional to Diesel Index is far from true, and it would probably be better to neglect the quality calculation entirely.

4—One of the very important quality considerations in crude oils is the quality of the gas oil for catalytic cracking. About one-third of the crude oil is usually fed to catalytic cracking units. The assigned value of 10% to the gas oil portion is low, and the characterization factor basis does not accomplish a very useful quality rating for this important fraction of the crude.

As a suggestion, we think it would be better if the author would first review the amounts of the crude oil that are processed to produce various products and reapportion the assigned values of the different fractions in proportion to the actual values that these fractions bring in open market.

He might then wish to review published refining procedures in order to find some relationship between the refining costs and actual product market value of the various crude oil fractions.

A roughly approximate average value to the refiner for each of the five major fractions separated from each crude oil might contribute a significant advance over the API gravity scale now in use. Any additional basis for altering these average product values as a function of the quality of the fractions from individual crudes would have to be done with a great deal of care and background in order to contribute something more worthwhile than merely using common values for each of the crude fractions from every crude.

The Author Replies:

THE PROPOSED Quality Index method is intended to replace the current method in use for buying and selling crude oil (API gravity ratings), and is not intended as an implement for breaking down crude oil involving precise technical testing methods used by research and development laboratories.

The currently used API gravity basis is an indication of the gasoline yield only, whereas the Quality Index method proposed in my article includes the yields of the five fractions generally obtained in the preliminary breakdown of crude oil using a simple Hempel distillation. No technical precision is claimed for this Quality Index method.

The quality considerations of the fractions are sound, because the choice of the key tests is based on their manifestation of performance characteristics, the difficulty in meeting their specification requirements, and the refining cost involved in accomplishing these ends.

The choice of the assigned values for the fractions is based on the existing market demand for products. The future may bring changes in product demands, in which case the assigned value can be changed.

As for gas oil, the larger portion is generally used to make No. 2 heating oil. Also, the characterization factor is an index of the structure of the fraction (paraffinicity, aromaticity, or naphthenicity) and a guide post to cracking propensities.

W. L. Nelson states* that, "Characterization factor is in many respects more satisfactory than other relationships because it is the only factor by which a single number can represent the entire crude oil or a part of it in the low or the high boiling point fractions."

Validity of the Quality Index method is best seen examining the 96 crudes listed in Table 3, and the examples in the test showing the agreement between separate tests on the same crude.

I feel that the reviewer's suggestions would in no way improve the formula balance, but would add much confusion and reduce the validity.

There is one way to improve the Quality Index ratings, namely performing the key specification tests in the laboratory instead of estimating them from the charts. However, this would greatly increase the expense of using the Quality Index, and would add very little to the actual overall precision of the rating, as shown below for tests involving six of the crudes listed in Table 3 (lube oil fractions are not included because actual test results were not available for them):

Crude Oil Sample	**No. 74**	**No. 18**	**No. 6**	**No. 77**	**No. 45**	**No. 58**
Gasoline Rating, R_1						
Actual Tests	20.5	15.5	11.2	13.4	11.8	8.9
Estimated Tests	18.6	12.8	14.6	12.0	16.5	7.9
Kerosine Rating, R_2						
Actual Tests	1.0	1.4	1.6	2.7	1.3	1.4
Estimated Tests	1.7	2.1	3.0	4.2	2.5	1.4
Diesel Fuel Rating, R_3						
Actual Tests	3.7	4.3	2.6	5.4	2.3	0.8
Estimated Tests	3.3	3.8	2.2	4.6	2.1	0.8
Gas Oil Rating, R_4						
Actual Tests	3.0	2.5	3.5	1.5	3.2	3.7
Estimated Tests	3.1	2.5	3.5	1.5	3.2	3.8

Fig 1 is not claimed to show direct test relationships similar to the other charts, and even the other charts do not yield precise results even though they show satisfactory correlations.

A tabulation of 38 crudes, 31 of which are in Table 3, show the relation betwen actual octanes and those from Fig. 1. Symbol R_1A indicates the gasoline rating using the actual octane number, and R_1C indicates the gasoline rating using Fig. 1.

Of the 38 gasolines, only 5 (13%) have a difference of more than 2 R_1 units (between Chart and Actual bases), and the remaining 33 ratings (87%) show differences varying from zero to two units.

The ratio between R_1A and R_1C values averages 1.1, confirming the validity of using Fig. 1 as a basis for calculating R_1 for the gasoline fraction.

Statistical calculations were made to develop the estimated equation showing the relationship between R_1A and R_1C, using the value given in the preceding tabulation. Further calculations were made to determine the coefficient of correlation between R_1A and R_1C. The resultant coefficient of correlation was 0.984, indicating the existence of excellent correlation.

*W. L. Nelson, *Oil and Gas Journal*, p. 94, March 9, 1950.

Meet the Author

Until his retirement early in 1955, David Rothbard was supervisor for 20 years of the control laboratory, Tidewater Oil Co., Bayonne, N.J., refinery. Before that, he was in Tidewater's research and development department for 12 years.

Mr. Rothbard received his B.S. in chemistry from Brooklyn Polytechnic Institute, and worked for the National Bureau of Standards, Washington, D.C. from 1920 to 1921 on test development and lubrication problems.

A previous contributor to PETROLEUM PROCESSING, he is the author of "Could You Use a 50% Increase in Productivity in Routine Control Laboratory Operations," December, 1955, pp. 1914-8.

"THE REAL WORK of the API is done by people on the many committees."

"API ACTIVITIES are as essential and beneficial to our company as they are to all who participate."

"THE BIGGEST accomplishment of the Refining Division . . . has been the work of the Smoke and Fumes committee."

API's Harry W. Ferguson . . .

New Vice President for Refining

THE SAME quiet energy and sense of direction that made Harry W. Ferguson one of the country's youngest top-level executives of a major oil company will be devoted, in part, to the many activities of the Refining Division of the American Petroleum Institute this year. Always active in the API, Ferguson is the Institute's newly-elected vice president for refining. He has been serving as vice chairman of the general committee of the Refining Division since Jan., 1956.

In daily life, Ferguson is vice president in charge of refining and sales for Humble Oil and Refining Co., Houston, Texas. Among his responsibilities are the 280,000 b/d Baytown refinery of Humble, and the top sales job of the biggest gasoline marketer in Texas.

From his native Mont Clair, Pa., where he was born in 1902, he went to the University of Michigan. "Michigan was one of the few schools offering courses in Chemical Engineering in those days," he explains. After graduation, in 1924, he went directly to Baytown as a chemical engineer in Humble's newly organized technical department. In 1929, he became head of the technical service division of the refinery, then moved to Houston in 1936 as assistant to the manager of the refining department.

He was made manager of refining operations in 1941; director of refining in 1945. In 1947, his duties were expanded as director of refining and sales, and he was made vice president in charge of these functions in 1951.

Around Houston and in the Humble organization, Harry Ferguson is known as a man who assumes his duties quietly and seriously. "I consider API tasks a part of my regular job. API activities are as essential and beneficial to our company as they are to all companies that participate."

He considers the public relations function of API as probably its most important job, and he acknowledges that "there is still a big job ahead."

"The biggest accomplishment of the Refining Division over the past few years has been the work of the Smoke and Fumes committee, and we will certainly continue our work in this field." Part of this work, he indicates, will take the form of "continued studies to develop information on air pollution."

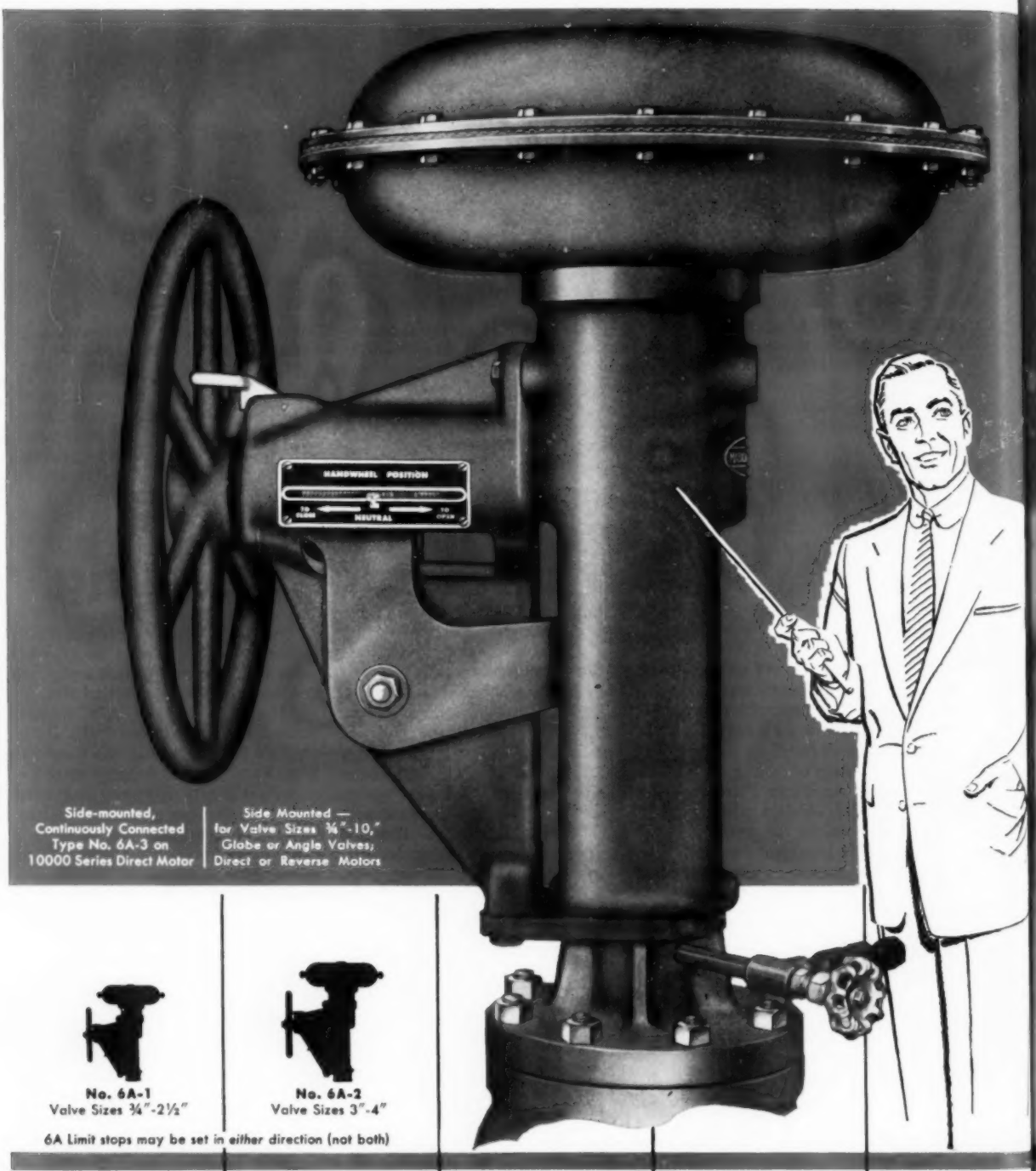
He is hopeful for further strides in the many other phases of activity of the Refining Division and expects many new problems to be studied by all committees during future years.

"Incidentally," he adds, "the real work of the API is done by the people on the many committees—and it is work, hard work." One example he cites is the committee on refinery equipment, whose work in standardization of equipment has simplified problems of both suppliers and refiners. Jobs such as this, says Ferguson, are the type of project that no company could do alone—only through hard work by members from all companies can such results be accomplished.

"The API is the only meeting ground for all phases of the industry." To hear him make this statement is to know that he believes it.

Affable Harry Ferguson has other tasks that he also seriously considers "a part of my job." One of these is chairman of the Waste Disposal Committee of the Houston Chamber of Commerce, a job he has held for the past two years. Under Harry's guidance, the major contribution of this committee has been to place the investigation of pollution problems in the area on a sound, systematic basis. On the committee's recommendation, Southwest Research Institute was engaged to make a thorough, scientific two-year study of the situation. From these studies, all industry in the area is hopeful that serious pollution problems will be averted and that their public relations job will be easier.

While he politely refuses the role of a prophet concerning the future of the refining industry, Ferguson regards past production of improved petroleum products for the public an indication that the industry will keep pace with demands for even better motor fuels and petroleum products. Discussing the advent of new, less fuel-sensitive engines, he sees no radical changes in motor fuel requirements in the near future, and says that present refining methods will probably be "effective" for the next several years.



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Side Mounted — for Valve Sizes ¾"-10," Globe or Angle Valves; Direct or Reverse Motors

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Valve Sizes 3"-4"

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Direct Motor

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Valve Sizes 2"-2½"
Direct Motor

No. 2-13
Valve Sizes 3"-4"
Direct Motor

No. 3-15
Valve Size 6"
Direct Motor

No. 3-18
Valve Sizes 8"-10"
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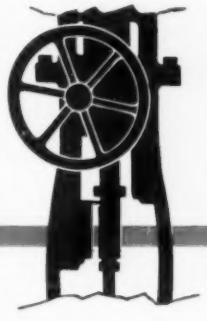
Valve Sizes 2″-2½″
Reverse Motor

No. 9-13
Valves Sizes 3″-4″
Reverse Motor

Limit stops may be set in *either* direction (not both)



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Direct Motor

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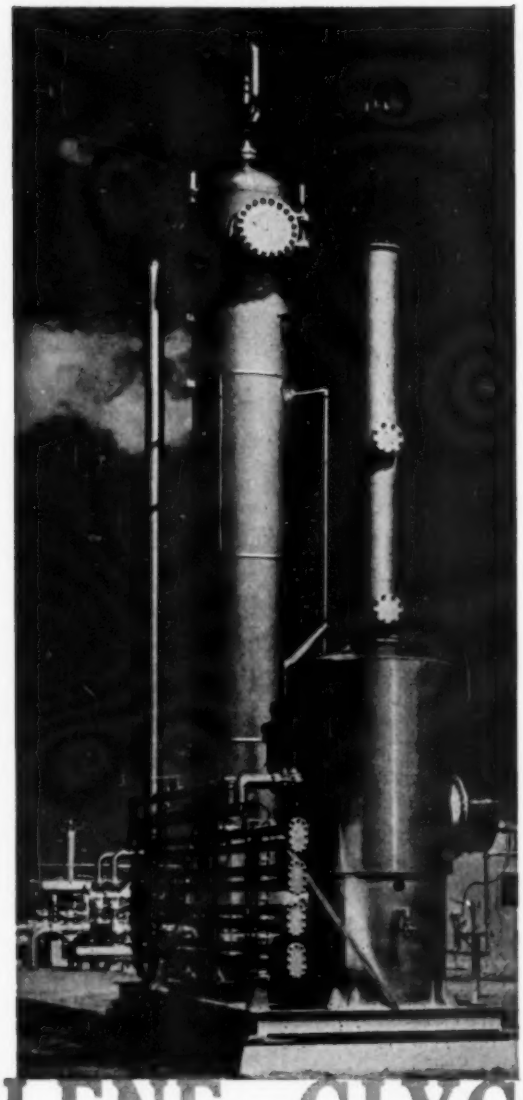
No. 6-18
Valve Sizes 12″-16″
Direct Motor

No. 7-24
Valve Sizes 12″-16″
Direct Motor

Case Mounted — for Valve Sizes ½″-16″, All Valve Types • Limit stops may be set in one direction only (upward travel)

(To obtain more data on advertised products see page 132)

Photo Courtesy of Blaw-Knox Company



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(To obtain more data on advertised products see page 132)

Your Guide to . . . Petroleum Processing Departments

Keep Your Data File Up-to-Date

"Clip-n-File" Process Data

Process References—III

Another coded, cross-referenced list of process literature. This month's data sheet covers specific subjects which appeared in PETROLEUM PROCESSING during 1956 **p. 83**

"Clip-n-File" Engineering Data

Glossary of Plastics—A-L

A helpful listing which may help reduce some of the confusion in your mind as to what trade-named plastic materials really are. **p. 103**

Practical Shop Hints

Four ideas you can use to advantage in your own plant in this month's Plant Practices including: use of TV in the maintenance shop, speeding up a dehydrator turnaround, better way to clean tanks, getting longer cooling tower life. **p. 87**

Teaching an Old Dog New Tricks

The Bull Pen boys had a problem, and the Old Man was in a bad mood. They'd been running into all kinds of headaches trying to lay a line through marshy land. Nasty Herbert's middlebuster' did the job. But see for yourself. **p. 91**

Practical Lab Hints

Some ideas you can use to improve your Laboratory Practices in this month's department including: a magnetic mechanism to smooth out flow in a sodium charging lock, and a capillary device to give you more accurate micro-tests. **p. 93**

What Do You Know About Law?

Of course there are "Legal Problems in Engineering," and that's the title of a new book reviewed this month in Books. Many aspects of law concern the technical man, and this book is a thorough discussion that will help you. **p. 101**

Two-Stage Catalytic Reforming?

Yes, says this month's featured Patent. It gives better yields and high octanes for gasolines by providing the "proper reaction at the proper time." You'll also find the usual listings of all new patents of interest to petroleum men. **p. 115**

"Optimal" Controller

. . . a new concept in process controllers, using some of the features of an analog computer is reviewed in this month's What's New along with over 50 other new products. And don't forget to see the "Picks of '56" on pp. 50-51 **p. 135**

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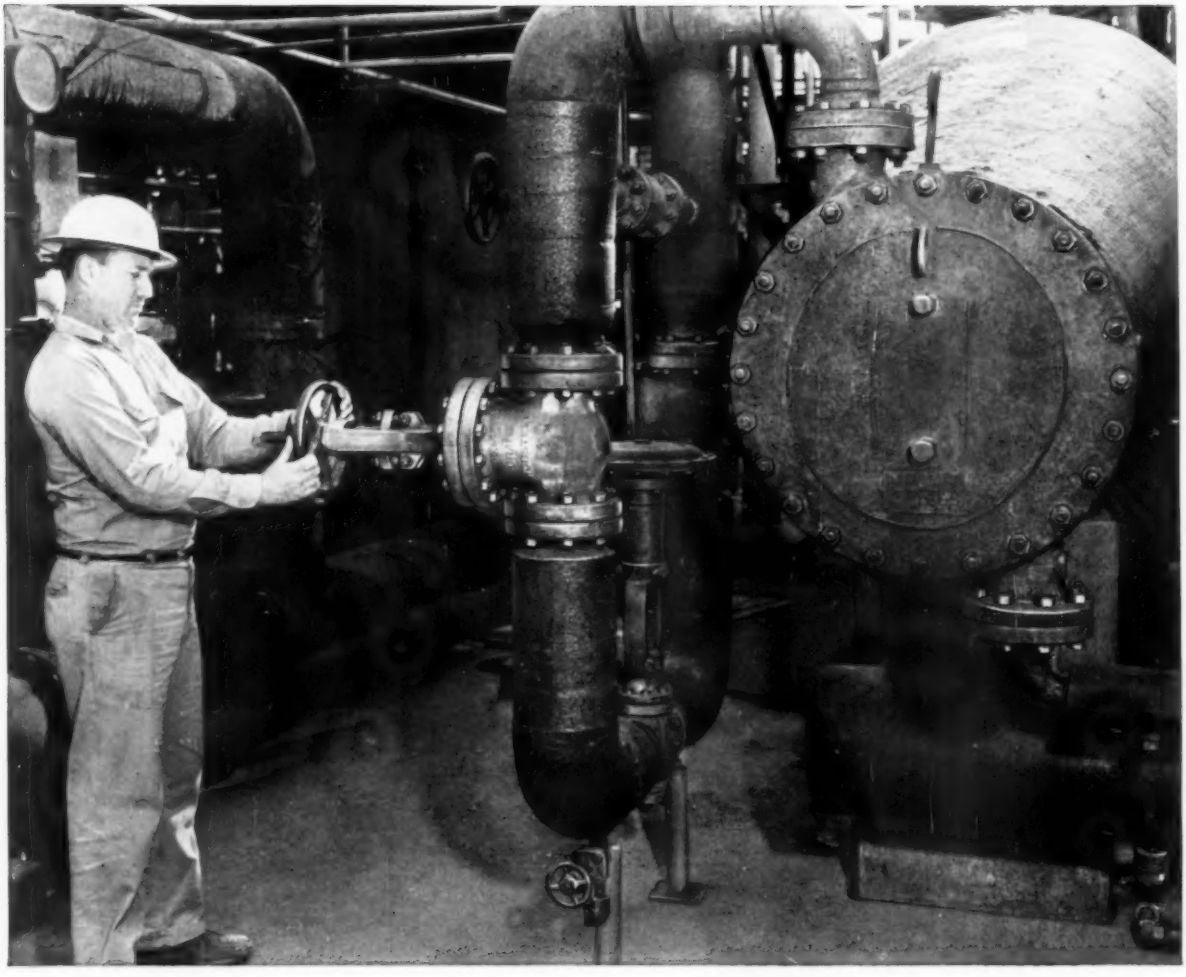

This Crane valve joins the "12-year service club" on steam

Valve performance like this looks good on any plant's cost sheets.

In 1944, Eastern States Petroleum Company installed this Crane 4-inch 33XR steel gate valve in its Houston refinery, handling 150 pounds of steam at 375° F. It's a busy valve—operation is frequent.

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How to Use the Process Reference List

This is the third process article reference list (others were PDS-9 for 1947, pp. 101-3, Aug., 1956; PDS-12 for 1955, pp. 143-5, Nov., 1956).

Key letters after each article listed tell you type of information to expect. For instance, **OPS** means the article has operating conditions, a process or plant description, and a schematic flow diagram. See Article Classification Key for definitions of other letter combinations.

Cross-reference letter-number combinations after each article listed refer to the Cross-Reference Subject Index —1956. These cross-references tell what specific subjects are discussed in the article.

Article Classification Key

C = Chemistry or Formulae
D = Design Data and/or Methods
E = Economics, Costs, and/or Markets
G = General or News Items
M = Materials and/or Equipment
O = Operating Conditions
P = Process or Plant Description
S = Schematic Flow Diagram
T = Theoretical Discussion
U = Utilities for Process
Y = Yields and/or Product Quality

Selected Process Article Listing—1956

F—Full-Length Feature Articles

F1—"Combination Unit Lowers Costs At New Baghdad Refinery," Dr. Nadhim Al-Pachachi, et al, Jan., pp. 58-61 **MPSY** (I-9,12,13,61,63,64,70: IV-7,28,29: V-23: VI-200,201)

F2—"From By-Product Hydrogen to Anhydrous Ammonia," J. H. Arnold & W. T. Dixon, Jan., pp. 62-6 **MOPS** (IV-2,13, 18,30: V-7,13: VI-19)

F3—"Anhydrous Ammonia—L'Azote Process," PDS No. 3, Jan., pp. 87-9 **EMOPSUY** (IV-2,6,15: V-16,18: VI-19)

F4—"How Sohio Makes Ammonia," Feb., pp. 47-50 **PSY** (IV-2,3,6,11,14,17,30,31: V-4,6,7,13,16,17,22: VI-19,20,77, 150,151,217)

F5—"Ethylene by Steam-Pyrolysis of Petroleum Stocks," PDS No. 4, Feb., pp. 87-9 **EMOPSUY** (IV-4,5,12,24,25: V-18: VI-35,40,86,183)

F6—"Montreal—A Major Petroleum Processing Center," Mar., pp. 72-81 **EPSY** (I-2,3,6,7,11,15,18,24,37,46,51,52,59,60, 64,65,68,70: IV-10,19,20: V-1,8,12,14,15,19,20: VI-5,7,18,54, 86,97,100,120,158,161,176)

F7—"Coke and Lighter Products from Low-Grade Oils by Fluid Coking," PDS No. 5, Mar., pp. 135-7 **EMOPSUY** (I-11,24)

F8—"How to Improve Quality by Chemical Treating," Apr. pp. 45-68

A—"Hydrogen Treating Crudes and Heavier-than-Gasoline Stocks," J. McAfee & W. A. Horne, pp. 47-52 **EOPSTY** (I-17,18,27,30,37,59: III-5,6,11)

B—"Chemical and Hydrogen Treating Petroleum Fuels Heavier Than Gasoline," W. W. Scheumann, pp. 53-7 **PSTY** (I-9,17,18,21,22,37,59,61,62)

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7—Catalytic Reforming (F6,8D,9,10,14, 18,19,29,32,36)
8—Catalysts (F33,36: P7,19)
9—Caustic Washing (F1,8B,8C,19,26: P6,8,10,11,14)
10—Clay Treatments (F17,19)
11—Coking (F6,7,23: P15)
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16—Delayed Coking (F23)
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21—Doctor Treating (F8B,8C,19)
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23—Electrofining (F31)
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26—Gray Desulfurization (F19)
27—Gulf HDS Process (F8A,19,33)
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29—HF Alkylation (F16)
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37—Hydrogen Proc.(F6,8A,8B,19,33:P19)
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39—Hydropretreating, Houdry (F19,33)
40—Hypochlorite Process (F19)
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C—"Removing and Converting Mercaptans," H. E. Walker & E. B. Kenney, pp. 58-66 **COPSTY** (I-9,13,17,18,21,22, 47,48,58,59,63,69)

D—"Pressure-Hydrogen Treating Petroleum Naphthas," M. Sittig, pp. 67-8 **EPS** (I-7,17,18,37)

F9—"Powerforming is No. 14," Apr., pg. 69 **GPSY** (I-7,53)

F10—"This Month's Technical Tips on Catalytic Cracking Problems," WPRA Panel Session, May, pp. 65-9 **MO** (I-6,7)

F11—"Why Adipic Acid Is Important Now and How It's Made from Cyclohexane," P. W. Sherwood, May, pp. 74-9 **CEOPSTY** (IV-1,6,19: V-2,3,9,17: VI-11,12,105,154)

F12—"Chemico Urea Synthesis," PDS No. 6, May, pp. 127-9 **EMOPSUY** (IV-8,31: V-4,6: VI-217)

F13—"More Gasoline and Less Coke," June, pp. 54-7 **OPSY** (I-6,57)

F14—"Catalytic Reforming Problems," WPRA Panel Session, June, pp. 76-82 **MO** (I-7)

F15—"Ethylene and Propylene," PDS No. 7, June, pp. 91-3 **EMOPSUY** (IV-12,24,25: V-22: VI-86,183)

F16—"Octane Improvement Problems," WPRA Panel Session, July, pp. 83-7 **MO** (I-2,6,44,56,60)

F17—"Lube Oil Improvements by Thermofor Continuous Percolation," PDS No. 8, July, pp. 137-9 **EMOPSUY** (I-10,46,67)

F18—"For Those Higher Octanes—Penex-Platforming of Naphthas," Aug., pp. 66-7 **EOPSUY** (I-7,44,49,51)

F19—"Sulfur in Gasoline—An Economic Appraisal," M. Sittig & G. H. Unzelman, Aug., pp. 75-95 **EPSUY** (I-4,7,9, 10,13,14,18,21,26,27,28,32,33, 34,37,39,40,41,47,52,55,58,59,61, 63,68,69)

F20—"Process Reference List—1947," PDS No. 9, Aug. pp. 101-3 PETROLEUM PROCESSING Articles (I-55: II-5: III-7: IV-27: V-21: VI-189)

F21—"Petrochemicals Forge Ahead Slowly," Sept., pp. 95-116 **EG** (V-11: VI-14,19,20,29,31,35,40,44,78,80,82,85,88,89,93,97, 112,151,169,173,176,197,200,202,204,210,221,222)

F22—"Petrochemical Plants in the U. S. and Canada—1956 Report," Sept., pp. 117-140 **EG** (Mostly listed in Section VI)

F23—"Coking Problems," WPRA Panel Session, Sept., pp. 141-4 **MO** (I-11,16)

F24—"Synthetic Ammonia—Kellogg," PDS No. 10, Sept., pp. 167-9 **EMOPSUY** (IV-2,30: V-13,16: VI-19)

F25—"Feed Preparation a Problem?" Oct., pp. 55-7 **EOPSUY** I-5,6)

F26—"Treating and Other Problems," WPRA Panel Session, Oct., pp. 87-90 **MO** (I-9,18,25,52,63,69)

F27—"Chemistry of Inhibitor Sweetening," R. H. Rosenwald, Oct., pp. 91-5 **COPTY** (I-41,63)

F28—"Isomerization of Normal Paraffins—Pentafining," PDS No. 11, Oct., pp. 101-3 **EMOPSUY** (I-44,50)

F29—"Cosden's New Rexformer," Nov., pp. 79-81 **GPSY** (I-7,16,51,56)

F30—"Burgeoning Maleic Anhydride," P. W. Sherwood, Nov., pp. 82-9 **COPSY** (IV-6,16,19: V-5,10: VI-127)

F31—"Acid-Treat Lubes Continuously," Nov., pp. 95-7 **EOPSY** (I-23,46,61)

F32—"Natural Gasoline Plant Platformer," R. E. Cox & R. H. Killgore, Nov., pp. 102-7 **OPSY** (I-7,51: II-4)

F33—"Petroleum Industry's Future—Hydrogen Processing," R. L. Davidson, Nov., pp. 115-138 **CEMOPSTUY** (I-8,17,18, 19,20,27,28,30,31,32,34,35,36,37,38,39,55,68: III-5,6,11)

F34—"Process Reference List—1955," PDS No. 12, Nov., pp. 143-5, PETROLEUM PROCESSING Articles (I-55: II-5: III-7: IV-27: V-21: VI-189)

F35—"Conventional, but BIG—That's the San Juan Plant," R. Cannon, Dec., pp. 48-50 **MOPS** (II-1)

F36—"Thermofor Catalytic Reforming," PDS No. 13, Dec., pp. 73-5 **EMOPSUY** (I-7,8,66)

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T1—"New Promise in Gamma Rays As a Petroleum Processing Tool," Jan., pp. 15-6 **GT** (I-54,64: IV-22,26: VI-140,190)

T2—"Gamma Ray 'Catalysis' Promising for Hydrocarbon Chlorination," Mar., pp. 15-6 **EGOP** (I-54: IV-9,22,26: V-5, 24: VI-32,126)

T3—"Atomic Radiation Now Feasible for Chain-Tupe Reaction Processes," Apr., pg. 16 **G** (I-54: IV-22,26: VI-140, 169,173)

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110—Hy
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112—In
113—Iso
114—Iso
115—Iso
116—Iso
117—Iso
118—Iso
119—Iso
120—Iso
121—Iso
122—Iso
123—Iso
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and Fibers?" May, pg. 16 **EGY** (IV-23: V-20: VI-173,175)

T5—"New Petrochemical Opportunities Sky-Wide in the Missiles Field," May, pg. 16 **EG** (VI-19,93,106,144)

T6—"Gas Liquid Recovery Men Watch Solid Absorption for Future," June, pg. 15 **GMP** (II-1,2,3,6,7)

T7—"Isotactic Polypropylene May Challenge Polyethylene, Nylon," Aug., pg. 16 **CEP** (IV-6,23: V-20: VI-173,175)

T8—"Coke and Fuels from 'Gilsonite' Necessity Is the Mother of . . . etc.," Sept., pp. 15-6 **GP** (III-1,4,8,11)

T9—New Ethylene Process Nearing Startup in Japan Promises Much," Oct., pp. 15-6 **GOPY** (IV-12,24: V-18: VI-86, 183)

T10—"Is Hydrocracking of Residual Fractions About to Come of Age?" Nov., pg. 16 **EGOPY** (I-30: III-5,6,11)

T11—"Outlook Broadens for Uses of Atom in Petroleum," Dec., pg. 16 **EGP** (I-54: IV-9,21,22,26: VI-32,126,169,173)

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P2—"Use Smoke Catalyst in Synthesis to Lower Catalyst Consumption," Feb., pg. 107 **OPS** (III-2,9,10,11,12)

P3—"New Process for Synthesis of Hydrocarbon Polymers," Feb., pp. 107-8 **OP** (III-2,9,10,11,12: IV-6: VI-174)

P4—"Activating Ion Exchangers Boosts Capacity for Mercaptan Removal," Mar., pg. 163 **OPY** (I-42,48,63)

P5—"Process Boosts Aromatics Yield During Hydrocarbon Synthesis," Apr., pg. 127 **OPY** (III-2,10,11,12)

P6—"Better Heating Oils with Cracked and Virgin Stock," Apr., pg. 128 **PY** (I-9,63)

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P11—"Two-Stage Sweetening with Solutizer and Caustic," Jul., pg. 160 **PY** (I-9,48,58,63)

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P13—"Remove Gasoline Diolefins with Activated Carbon," Jul., pp. 160,3 **OPY** (I-1)

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140—Methyl Methacrylate Resin (T1,3)
141—Methyl Propyl Ketone (F22)
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143—Methyl Vinyl Pyridine (F22)
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222—Xylenes (F21,22)

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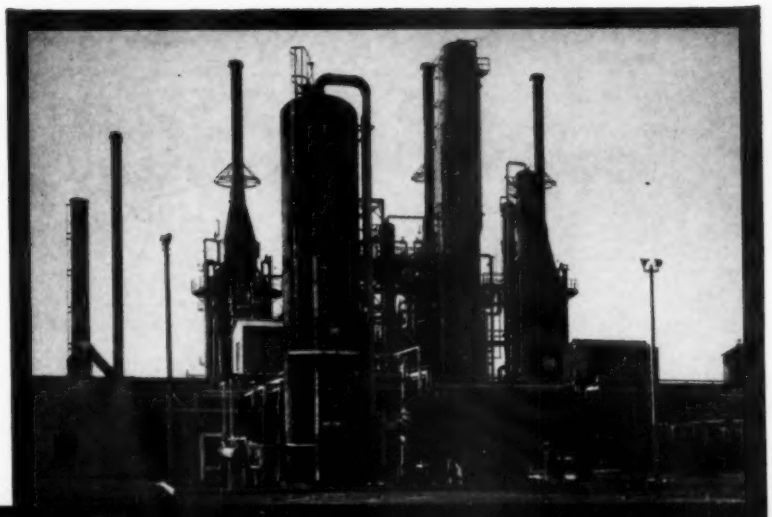

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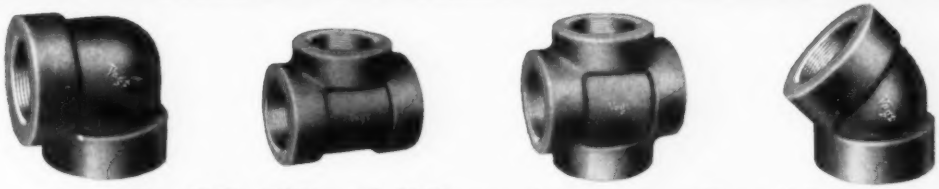

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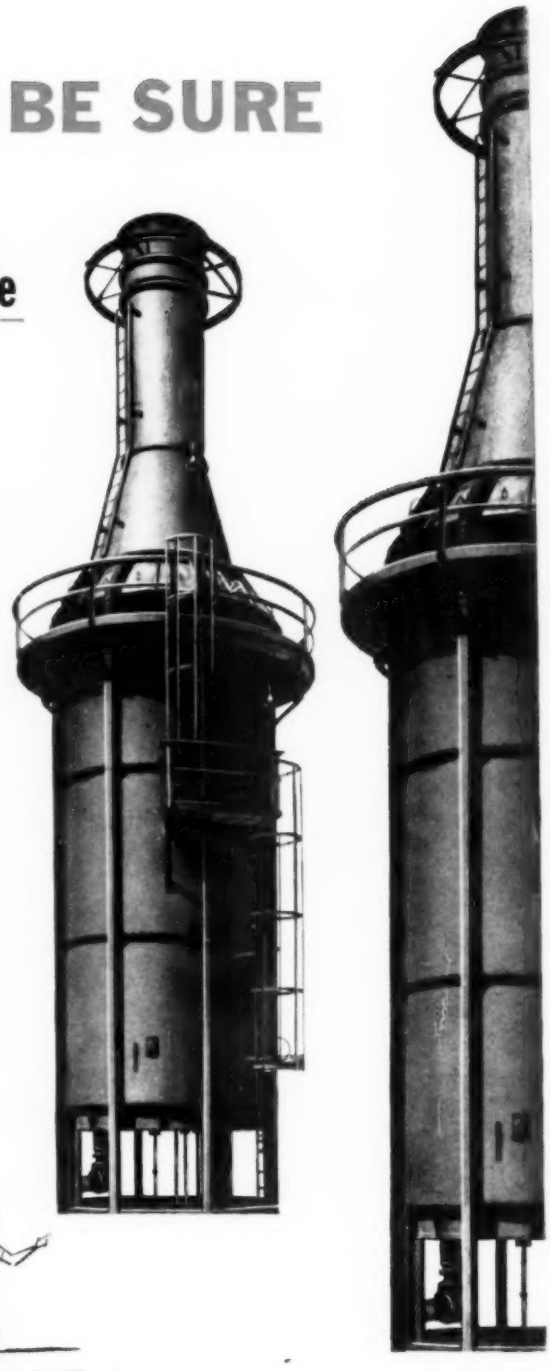

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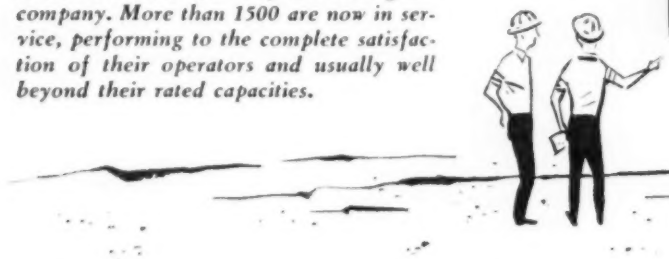

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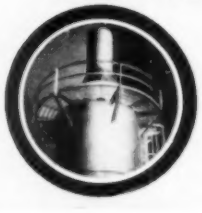

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TV in the Machine Shop

Saves Valuable Conditioned Air

HAVE YOU got some trouble spots around the shop that you'd give an arm, almost, to see? If the trouble at these spots is costly enough, a simple industrial TV system might be the answer. This is what Esso Standard Oil Co. did at Baton Rouge.

When the new central mechanical building was completed a few years ago, it was the last word in modern maintenance operations and included air conditioning. But guiding the full-scale traffic that rolled in and out of the building cost lots of conditioned air in summer and heated air in winter. Alternatives were expensive.

The traffic pattern was one-way, with vehicles moving in through a huge roll-up door on one side of the 225-ft-wide structure, loading or unloading inside, and then moving out through another huge roll-up door on the opposite side of the building. Control of the traffic was done by the dispatcher whose office was located at the entrance door. It was not only difficult to close the door at the right time but also was hard to get an unobstructed view across the 225 ft space because the vehicles were constantly loading and unloading in the building.

Although it doesn't offer Dagmar, the installed TV channel has solved the problem of losing valuable conditioned air. A camera is mounted high in the rafters of the building, with a clear view of the exit door. The receiver is in the dispatcher's office, and its only "program" is the exit door on the other side of the building.

TV CAMERA IS HIGH in rafters of shop, has clear view of exit

When a truck leaves the building and has cleared the roll-down door, the dispatcher presses the "close" switch as fast as he can to prevent as much of the conditioned air as possible from following the truck outside. A floor switch near the exit door signals the dispatcher when to open the large door so that he does not have to keep a constant watch on the TV receiver.

Turn page for more Practices . . .

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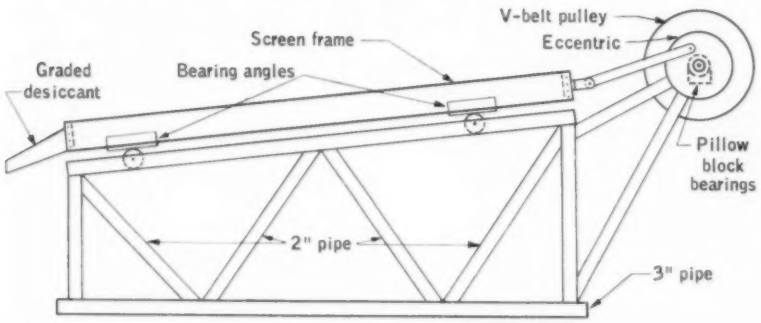
"Scrap" Shaker Speeds Up Turnaround



CATALYST BEDS and desiccant beds will eventually become plugged through attrition and with foreign material from incoming lines. The fines, which usually cake in the bottom of the beds, must then be screened out and the catalyst or desiccant replaced.

United Gas Pipe Line Co. has this trouble in the dehydrators of its Carthage Gasoline Plant at Carthage, Texas. To speed screening the desiccant, United personnel rigged up a plant-built "shaker" of scrap pipe, plate steel, discarded roller bearings, and an old vee-belt pulley.

United's "shaker" has a screen, about 3 by 10 ft, with sides of 2 by 6-in. lumber. The screen is supported on a framework of 2-in. pipe and is sloped to one end so that screened desiccant flows through a chute at the lower end to be bagged, barreled, or returned to the dryers. The wood sides of the screen have bearing angles and guides that keep the moving screen on roller bearings attached to the top rail of the supporting framework.

Steel bracing projecting from the pipe frame supports a shaft mounted on pillow-block bearings. On one end of the shaft is a vee-belt pulley and on the other end is an eccentric, made from ⅜-in. plate steel. A connecting rod from the eccentric to the screen keeps the screen in motion, separating fines from salvaged desiccant quickly and thoroughly.

The driver pulley can be driven by almost any power available—small gasoline engine, electric motor, or power take-off on a truck.

Although helpful to any screening operation, the "shaker" is particularly valuable when a dehydrator must be shut down and returned to service with a minimum of downtime.

Because portability is desirable to scattered gas plant operations, United Gas has built its screening shaker so that it will fit into a pick-up truck and can be moved to any location quickly and easily.

Special Manhole Aids Tank Cleaning

By Frank J. Scheilbaum*

TANK CLEANING at the Union Oil Company's Los Angeles refinery has been speeded up and made easier by the installation of a new type manhole. It is designed for storage tanks 60 ft in diameter or larger.

The manhole is 4 x 4 ft in diameter, with square corners on the bottom and rounded at the top. The flat bottom of the manhole is flush with the tank floor, making it easy to drain or force the tank's contents through the opening. B.S.&W. can be scraped out of the tank through the door into a temporary hole just outside. A vacuum truck can then be used to remove material from the outside hole.

The larger opening also allows more light and fresh air to enter the tank. The new hole also makes it possible to get wheelbarrows and other equipment into the tank for a thorough cleaning job.

Two lifting lugs are welded to the tank above the manhole, making it easy to remove and re-install the cover. One lug is three feet directly above the center and the second is at the same height but five feet to the side. This permits lifting and storing the door out of the way at the same time.

*Mr. Frank J. Schleibaum is Rigger-Labor foreman, Los Angeles Refinery, Union Oil Co. of California.

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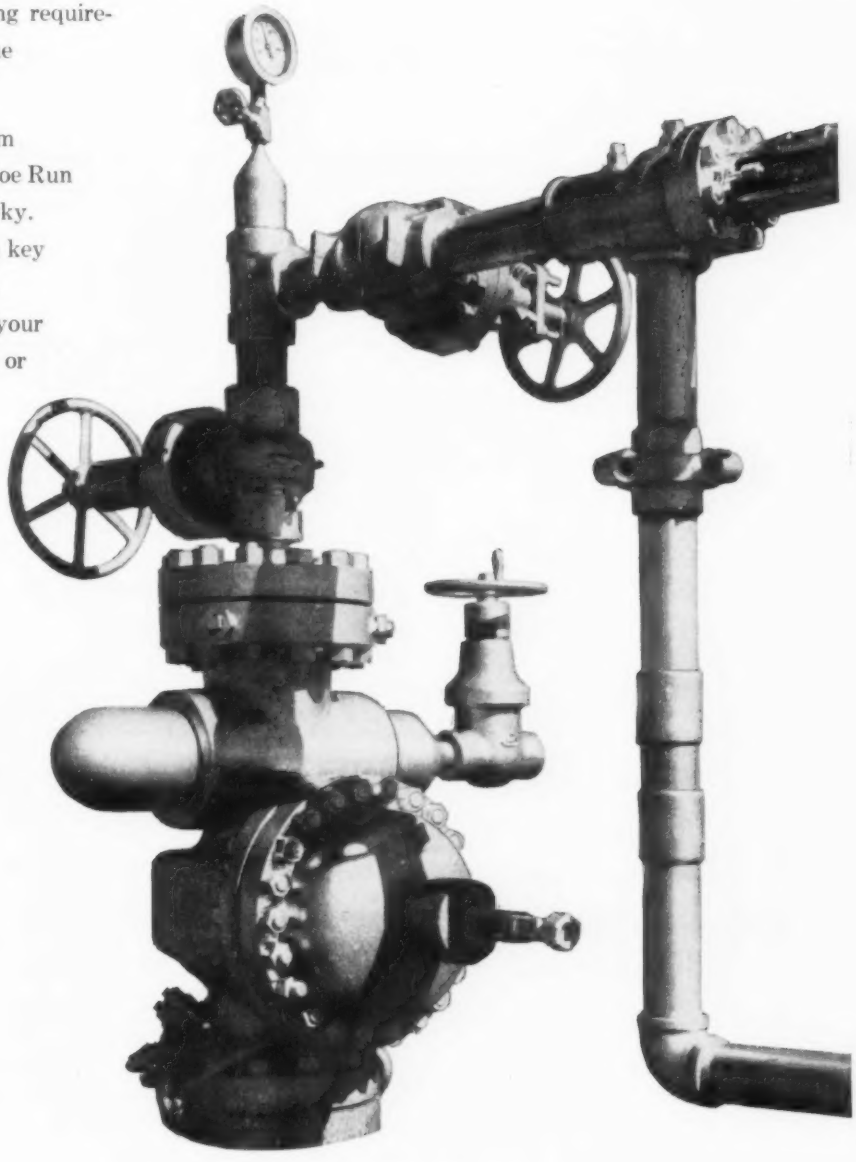

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"Betcha I could lay that li'l ol' pipe in two weeks . . ."

Teaching an Old Dog New Tricks

THE OLD MAN was in bad mood and had been for over a week. He had called the Bull Pen and told me to meet him out at the products pump house right away. I knew I was in for a bad time—not from the Old Man, but I could tell he had a job for me, and I knew what the job was going to be.

We had a crew out just starting to run a 4-in. butane line from the refinery products pump house out through 6 or 8 miles of marshy swamp to where some pipe line outfit would pick it up.

This job had been the talk of the Bull Pen for a week —they had a half-yard dragline out there trying to dig the trench and a side-boom cat laying the pipe. Trouble was, they hadn't laid the first joint of pipe because they couldn't keep the ditch open in the muck. As a matter of fact, the dragline hadn't dug over a hundred feet in a week because it kept bogging down. They had to keep the machine on matts—and that was slow going.

Anyway, we all knew the Old Man was hot to get the job moving, and sooner or later he would be chasing one of us out there to try to get a little action. We all dreaded those marsh jobs like the plague. I was the guy who caught this one.

The Old Man was waiting for me at the pump house. As I said before, he was in a bad mood. He had wanted to contract this job in the first place, but the general superintendent insisted that we do it with plant forces. The way the job was starting off was enough to give anybody a pain in the neck and the Old Man was particularly susceptible to pains during a slow job. It looked like this one was going to last a long time—six miles is a lot of marsh.

The Old Man was being as patient as he could under the circumstances, "I don't know how you're gonna do it, but I want this job ironed out in a hurry. Get more manpower out here, sheet that ditch if you have to, but get that pipe in the ground."

"Nasty" Herbert, who looks like his nick-name sounds, was standing nearby taking all this in. "Shore gonna take a messa sheet pilin' for six mile of ditch." The Old Man was in no mood for comments like this from anybody, let alone Nasty, and I drew back expecting a blast.

"I don't give a damn how much sheet piling it takes, get that pipe in the ground," he yelled.

"Ah betcha ah could lay this little ol' line in two weeks with nary a sticka sheet piling and half the people you got out here," Nasty said. Nasty had a knack for saying the wrong thing at the wrong time, and I could see that his last remark filled both requirements. The Old Man was about to blow a gasket.

"All right, smart guy, how you gonna lay that line in two weeks?"

"Well, ah was borned on a farm, an' . . ."

"The devil with your life story! How you gonna lay that line?" The Old Man was running out of patience.

"Ah'm tryin' to tell ya. Out on the farm, we usta break the ground with a ol' middlebuster plow. Now if you could rig yourself up a middlebuster with a set of rollers between the blades, you could weld your little ol' pipe up from here to hell and gone right on top the ground. Then all you have to do is set the pipe in the rollers, hook onto the plow with that cat and pull. The plow will folla the line, dig the ditch, and the pipe will fall right in the ditch behind the plow. Soft as this ground is, it'll probably even back-fill itself."

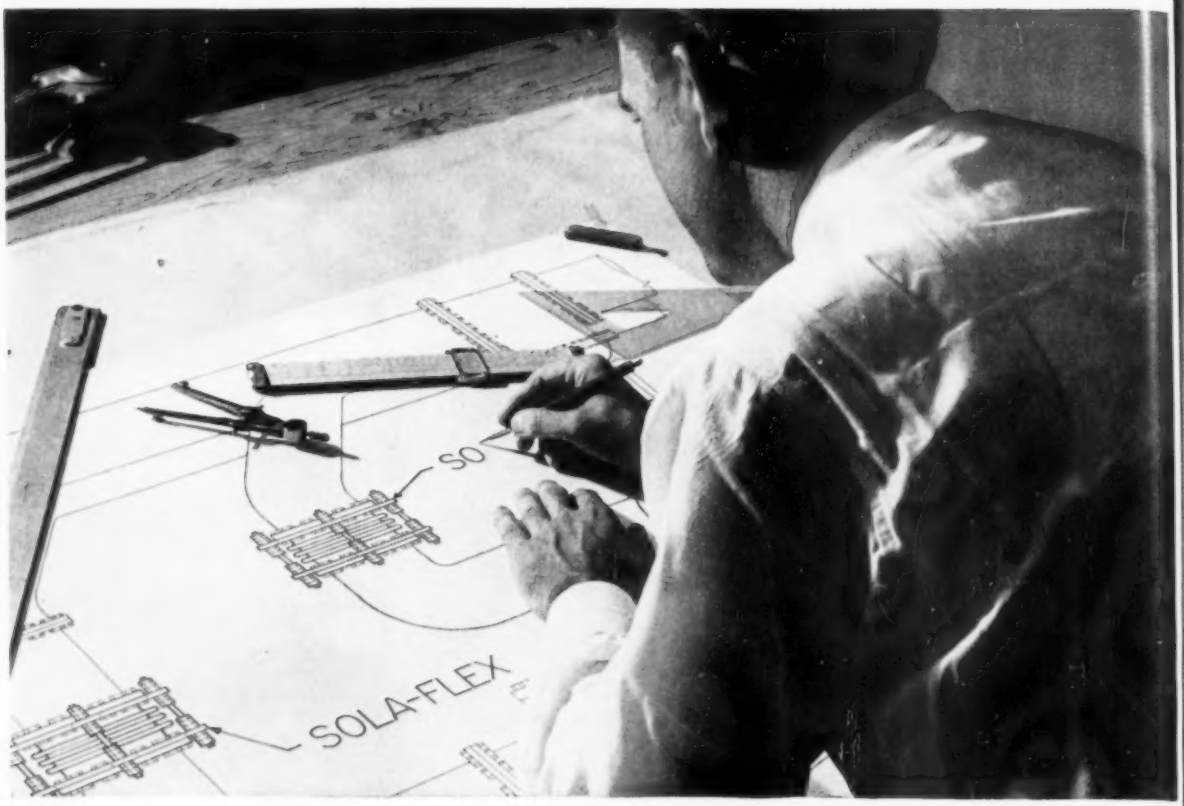
By morning, we had ourselves a big middlebuster made out of old plate steel and angle iron. Somebody had found three old conveyor rollers and we had mounted them between the blades to guide the pipe. The draw bar had a chain yoke and a shackle to hook the winch line to.

The Old Man was there about ten o'clock when we had the rig ready to try out. The cat was out to the end of his winch line and hooked onto the plow. Well, when he started to pull that plow, you never saw a pipe disappear so fast. I could see right away we'd have to have more welders to keep up with that thing.

Riding back to the Bull Pen with the Old Man, I could see he was still disturbed. I soon found out why.

"I don't mind being shown up by anybody with any sense—but, Nasty,—that's the last straw. But, I guess everybody has a good idea now and then, if you've got sense enough to listen."

Me, I was so happy to get away from that marsh job, I could have kissed Nasty—well, almost.



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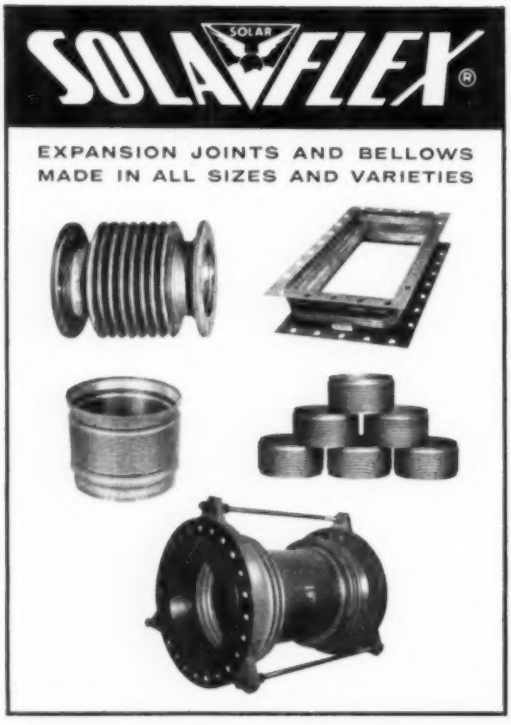

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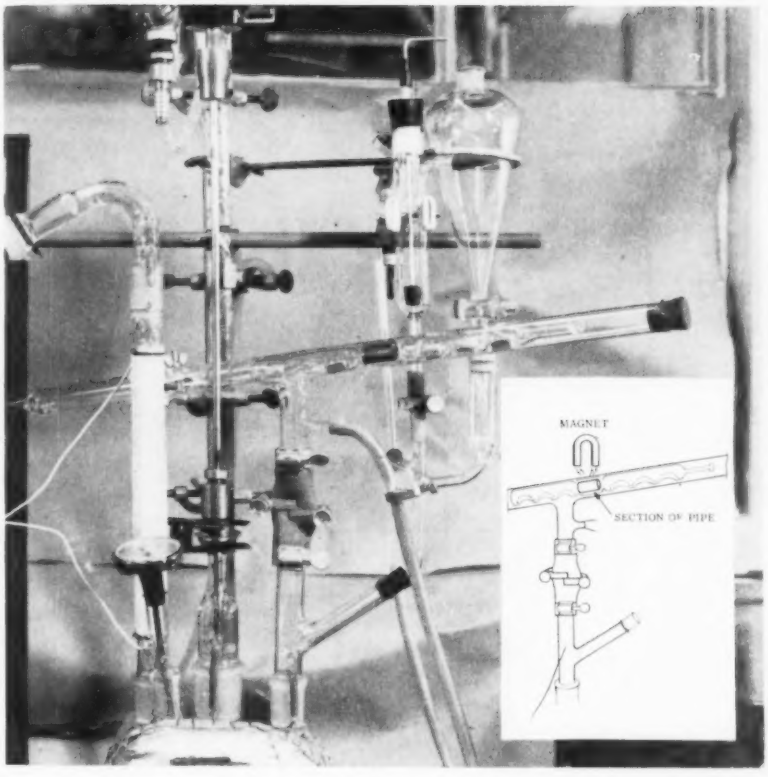


Sodium Charging Lock Uses Magnet For Smooth Feeding

By J. L. BOYD*

FOR PREPARING a fluidized bed of sodium hydride, dispersed on finely divided inert material, Sinclair Research Laboratories in Tulsa, Okla., had used an arrangement suggested in a U. S. Industrial Chemicals Co. bulletin, *High Surface Sodium*. But the operation of the equipment did not permit a good balance between the metallic sodium and hydrogen fed to the system. It was also impossible—because the fluidized bed was held above the melting point of the sodium—to prevent flashes caused by included air.

To eliminate these difficulties, the charging lock was modified as shown above. A sodium pellet carrier with six depressions was formed from 18 mm OD Pyrex tubing. Inserted in the center section of the glass tube is a 25 mm length of ¼-in. metal pipe, sealed eccentrically. The sodium carrier is held within the modified air-lock, made of 22 mm OD tubing. The carrier is permitted to move back and forth within the inclined portion of the T-shaped lock.

Addition of the sodium pellets, or blocks of metal, is controlled by moving the carrier along the inclined portion of the lock with a magnet held above it. The feeder is first loaded by inserting the sodium filled carrier into the lock, which has been previously purged with nitrogen. Before the stopper is inserted, the carrier is inverted, so that the piece of metal pipe is on top. Then, as the magnet is moved along the tube above the metal pipe section, the pellets can be dropped, one by one, into the flask below.

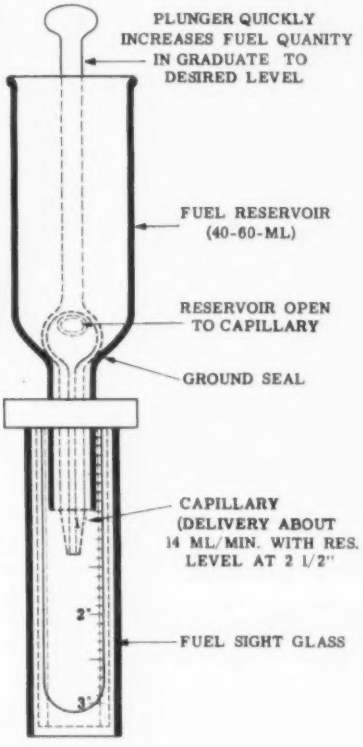
Using this arrangement guarantees exclusion of air from the system while the sodium is being fed. It also maintains an excess flow of hydrogen to the system.

*Mr. J. L. Boyd is a member of the Sinclair Research Laboratory staff in Tulsa, Okla.

Capillary Device Aids In Accurate Short Samples

By WARREN W. HUSS*

BECAUSE many test samples for determining motor or research octane are in short supply, several different modifications of the standard method are used. Some laboratories accomplish "micro-testing" by eliminating the carburetor bowl and supplying gasoline directly to the sight glass level indicator. Then, by using a quicker time constant setting on the detonation meter, a knock meter reading can be determined as the level of the gasoline falls past that which provides maximum knock. However, it has been noted that the level falls too fast to provide a reasonably stable detonation value.


PLUNGER QUICKLY INCREASES FUEL QUANITY IN GRADUATE TO DESIRED LEVEL
FUEL RESERVOIR (40-60-ML)
RESERVOIR OPEN TO CAPILLARY
GROUND SEAL
CAPILLARY (DELIVERY ABOUT 14 ML/MIN. WITH RES. LEVEL AT 2 1/2"
1"
2"
3"
FUEL SIGHT GLASS

The device shown here is a capillary arrangement that will supply fuel to the sight glass at a rate slightly less than required by the test engine. This creates a modified falling level that

*Mr. Warren H. Huss is a research engineer with the Tidewater Oil Co. at Associated, Calif.

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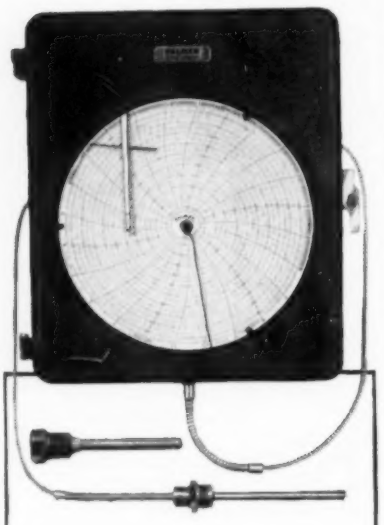

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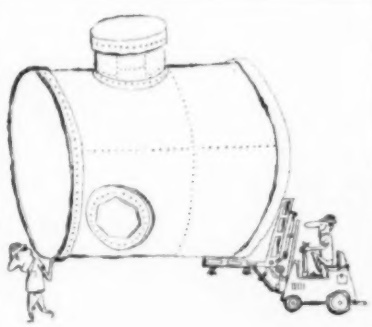

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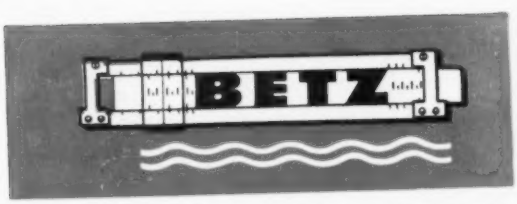

CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

W. H. & L. D. BETZ, Philadelphia, Pa.

Financial Aid to Higher Education

A Fine Start, But...

This editorial has two purposes. The first is to salute American business for the fine start it has made in helping to relieve the financial plight of our colleges and universities. The second purpose is to stress the importance of having business provide more financial aid, and soon.

How Business Helps Higher Education

Business contributions to higher education doubled between 1950 and 1955. They jumped from $40 million to $80 million. Preliminary figures indicate they will be even higher this year.

Business firms have also shown a lot of ingenuity in devising different ways of making their contributions. The methods range from a matching of an employee's contribution to his particular alma mater to wide diffusion of the money through state and regional money-raising associations of colleges and universities. Thanks to this ingenuity, business firms now have a wide choice of ways by which to give effective aid. The way most appreciated by college administrators is the making of gifts unrestricted as to the purpose for which the money is used.

Imposing as it is, however, what business has done thus far is only a good start. Only a tiny fraction of the total number of business firms in the country are giving direct financial help to our colleges and universities; and this fraction includes fewer than half of the hundred largest corporations in the country. Also, the amount of financial help being provided by business constitutes only a very small fraction of what is needed.

Why Colleges Need More Aid

Right now our privately endowed colleges and universities need about $350 million more in operating income a year than they are receiving to enable them to pay decent faculty salaries and be in tolerably good working order otherwise. The reasons, including a severe decline in the purchasing power of their endowment income because of price inflation, have been dealt with in the previous editorials in this series.

In addition, these institutions, together with the tax-supported schools, are faced with a tremendous increase in enrollment over the years ahead. With both a rapidly increasing population of young people and an increasing propor-

tion of them going to college, this year's enrollment of 3.2 million students is expected to reach 4.0 million by 1960, and to be doubled by 1970.

For the next ten years our privately supported colleges and universities must have an average of about $400 million a year above what they can be expected to collect from tuition fees, income from endowment funds, etc.

This figure of $400 million does not include what is needed for new buildings and equipment. It also does not include help for tax-supported schools above what they get from taxes, fees, etc. Business has given and will continue to give these schools substantial aid. Indeed, almost 25% of the financial help from business for our colleges and universities went to tax-supported schools in 1955.

If aid from business met their needs for increased operating income, the privately supported colleges and universities would be given a decisive lift in performing successfully their part in our system of higher education. They would still have large needs of capital equipment — buildings, dormitories, laboratories — but help from other sources, such as that provided by devoted alumni, where they are well organized, could be expected to go far toward meeting these needs. Also some companies prefer to concentrate on meeting needs of this type.

What 1% of Profits Would Do

But do business firms have the capacity to fill the gap in adequate operating income for our privately endowed colleges and universities without putting an excessive financial burden on themselves? Those who have studied this capacity carefully say that the answer clearly is yes. If, of its profits before taxes — this year an estimated $43 billion — business were to devote 1% to helping our privately endowed colleges, it would take care of present operating needs of about $350 million a year. And the balance of $80 million would be a big step in meeting their needs for new buildings and equipment, too.

About one half of a 1% contribution of this sort would, in effect, be made by the federal government. Up to a limit of 5%, contributions of this type are exempt from the federal corporate income tax. For corporations with incomes above $25,000 per year this tax is 52%.

It is clear that not all business firms are in shape to devote 1% of their profits to aid to higher education. Even in this year of record-breaking prosperity, many of them will have no profits at all. But if business generally would take 1% of pre-tax profits as a target or benchmark for financial help to our privately endowed colleges and universities these institutions would again have sturdy financial foundations.

Relatively this is a very small price to pay (1) to insure a continuing supply of competently trained young men and women and (2) to buttress our freedom by assuring the successful survival of the privately supported sector of our system of higher education.

This is one of a series of editorials prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments of particular concern to the business and professional community served by our industrial and technical publications.

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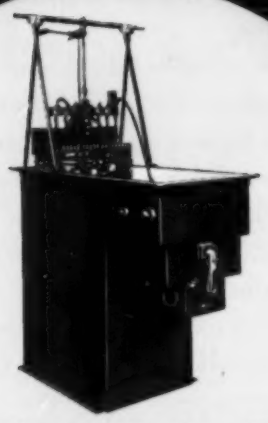
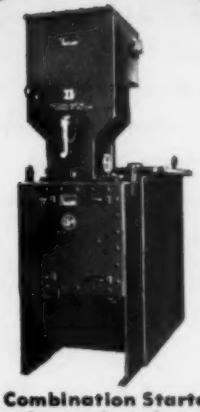


Type AT Combination Starter shown with Contactor and Overload Panel raised above the oil level without disconnecting any bolts or leads—in NEMA 3R enclosure for outdoor mounting, available in 50,000 KVA (certified) interrupting capacity.



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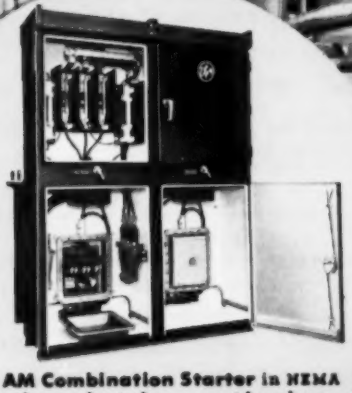

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NEW WORDS

By B. H. WEIL
Manager, Information Services
Ethyl Corp. Res. & Engrg. Dept.
Detroit, Mich

A regular department intended to help both administrators and operating men keep abreast of technical names and processes in the petrochemical field.

Hydrogen Cyanide

Hydrogen cyanide, also known as hydrocyanic acid and prussic acid, is pronounced "**high**-dro-jen **sigh**-ahnide" and has the simple molecular formula HC—one atom of hydrogen, one of carbon, and one of nitrogen. A water-white liquid at room temperature (below 80°F), its vapors are intensely poisonous and have the faint odor of bitter almonds (as is briefly known to the criminals executed by it in certain states). It has been a petrochemical for less than a decade, but is now a highly important one.

Traditionally, hydrogen cyanide has been produced by treating a cyanide salt (such as sodium cyanide) with an acid (such as dilute sulfuric acid). The cyanide salt is itself produced from metallic sodium, ammonia, and carbon. Petrochemically, hydrogen cyanide is prepared by the catalytic reaction of ammonia (NH_3), natural gas (methane, CH_4), and air (oxygen, O_2), which yields HCN and water. As mentioned frequently in this series, ammonia is a petrochemical by virtue of its synthesis from natural-gas-derived hydrogen or byproduct hydrogen from the catalytic reforming of naphthas.

Hydrogen cyanide is used in the synthesis of acrylonitrile, which is a prime ingredient of the acrylic fibers and a constituent of GR-N (oil-resistant) synthetic rubber. HCN is also employed in the manufacture of acetone cyanohydrin, used in the production of the acrylate (transparent) plastics; in the manufacture of adiponitrile, a raw material for nylon production; and in the production of various cyanide salts, dyes, and fumigants. As can be seen, these are important applications, and explain why hydrogen cyanide is now produced to the extent of hundreds of millions of pounds annually.

Dibutyl Phthalate

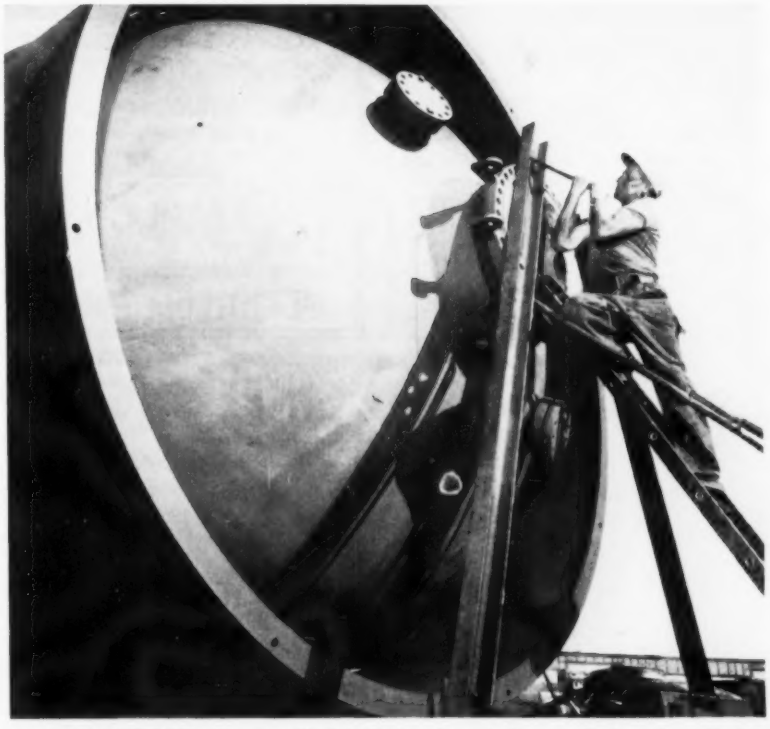
Dibutyl phthalate, like many other petrochemicals, was once produced exclusively from nonpetroleum raw materials. Pronounced "die-**beu**-til **thal**-ate," it is a colorless liquid, slightly heavier than water per unit volume, and boiling far above the latter's boiling point. It has the formula $C_6H_4(COOC_4H_9)_2$, and is prepared by the "esterification" of phthalic anhydride with *n*-butanol (normal butyl alcohol). Esterification, incidentally, involves the reaction between an organic acid (R•COOH, where R is a hydrocarbon radical) and an alcohol (R′•OH, where R′ is also a hydrocarbon radical) to yield R•COO•R′ molecules plus the splitting out of HOH (water). Phthalic anhydride has two (potential) acid groups and thus is a "dibasic" acid, requiring reaction with two alcohol molecules for esterification.

Dibutyl phthalate is a well-known chigger repellant and insecticide. It is also used as a plasticizer, as a perfume-oil solvent, as a perfume fixative, as a resin solvent, as a textile lubricating agent, and in safety glass, leather dopes, printing inks, etc.

Phthalic anhydride, the basic raw material for dibutyl phthalate, is prepared by the catalytic air oxidation of naphthalene or *ortho*-xylene; both may be obtained from petroleum fractions, although only the latter is currently so derived in large quantities (from catalytic reformates). *n*-Butanol is prepared from natural or refinery gases by several routes—synthesis from petroleum-derived ethylene or acetylene, as a co-product in the oxidation of LPG, as a byproduct of the Synthine (Fischer-Tropsch) synthesis of gasoline from natural gas, etc.

Phthalate esters such as dibutyl phthalate find many uses, the reason for the heavy demand for phthalic anhydride. Indeed, the latter is as "popular" a chemical as its dibutyl derivative is unpopular with chiggers.

NEWS in VIEWS



ONE OF THREE 60-ton cylindrical chambers being readied for installation in the new Sovaformer at Socony Mobil's East St. Louis refinery. Made of 2-3/16 in. steel plate, these units are both more pressure resistant and economical than the conventional cylindrical chambers in Sovaformer reactors. Reactions will take place at 600 psi and 650 F.

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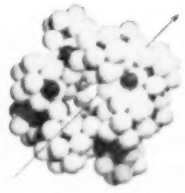

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P. O. Box 51, Linden, N. J.

How Well Do You Know Your Law?

Legal Problems in Engineering, by Melvin Nord, 1956, 6 x 9 in., 391 pp, stiff cloth cover, $7.50, John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y.

EVERYBODY has a legal problem at one time or another in his life, regardless of his calling. Engineers, however, and particularly professional engineers, may very well be among those whose daily work routines bring them into close contact with legal problems quite frequently. This is especially true of consultants and of engineers engaged in contractual work in design and construction.

Few engineers, unfortunately, also become well-grounded and trained in all the aspects of the law profession. Like any other citizens, they too must turn to a specialist.

Here is a book which will help such engineers to reach a better understanding of the law. It will perhaps smooth the way for a somewhat easier relationship between a professional engineer and the attorney he must work with. It is not designed to make a lawyer out of an engineer in "six short lessons." It is, however, designed in a textbook fashion, and could be used as the text for a formal course.

Because of the good writing style and very clear language, however, this book can be studied at leisure and it can bring the engineer a great deal of very helpful information. Many important aspects are covered. Following a general introduction explaining the basic fundamentals of law, the book is broken into three major parts: legal principles for engineers, professional problems of engineering, and engineering-legal problems.

The first part deals with such things as contracts, insurance, property, workmen's compensation, public utilities, municipal corporations, and labor law. The second—a very important part of the book—deals with the ethical responsibilities of the engineer and professional registration. The last gets into construction contracts, government regulations on business, patents, copyrights, and trademarks. It includes a very timely chapter on air and stream polution.

Method of presentation is somewhat unique. It is neither the "pure textbook method" nor is it the "casebook method." The author points out in his preface that the casebook approach is too slow for efficiency and the textbook style fails to bring legal points home by placing them in context in actual fact situations. He terms his method the "problem" approach. Legal principles are explained in text style, and a sufficient number of cases are given as illustrations and problems so as to put the legal principles in factual context. The cases are "digested" in language and length to avoid unnecessary legal jargon and discussion

Melvin Nord comes well equipped to present this book. One of the so-called original atomic engineers, he holds both a doctorate in engineering science and a law degree. A vice president and consultant to Petro-Chemsol Chemicals Ltd. of Canada, Dr. Nord practices as a consultant in legal and engineering problems and as a patent attorney. Since 1950, he has lectured on law and engineering at Wayne University, Detroit.

Book Briefs

Fisher Tag Manual for Inspectors of Petroleum, 1956 Revised Edition, 200 pp, hard cover, $1.75, Fisher Scientific Co., 389 Fisher Bldg., Pittsburgh 19, Pa.

. . . 37 ASTM test methods most used by field men reduced to essentials for field use. Added in this edition are the most important gravity and viscosity tables and other reference and conversion tables. Copper corrosion test (ASTM D-130) is revised with new ASTM specifications. Conversion tables now include 42-gal barrel.

Fire Protection in Natural Gasoline Plants, Coded as API RP 2002, American Petroleum Institute, 50 W. 50th St., New York, N. Y.

. . . how to set up a fire protection program—equipment to use and a model employe training program—is detailed in this publication by the API Safety Committee on Natural Gasoline.

Transport Processes in Applied Chemistry, by Dr. R. C. L. Bosworth, 387 pp, 5½ x 8½ in., hard cover, John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y.

. . . processes are given a common phenomenological description, in terms of driving force, flux, resistance and rate of dissipation of energy. Author's "carrier" concept is used and the kinetic mechanisms of the transport processes are discussed on the basis of the types of carrier responsible for the flow. He develops theory of a "Grand Transport Process" to express a whole series of coupled transport processes under certain conditions.

1952-53 Bibliographic Survey of Corrosion, 382 pp, 8½ x 11 in., hard cover, $12.50 ($10 to members), National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2, Texas.

. . . summaries of 3344 articles, books and brochures. Abstracts are arranged topically in eight groups: general, testing, characteristic corrosion phenomena, corrosive environments, preventive measures, materials of construction, equipment, and industries.

EPA Technical Digest, 1956 Vol., No. 1, January, unpaged, paper bound, 8 x 10½ in., $2.50, published by European Productivity Agency of the Organization for European Economic Cooperation, distributed by OEEC Mission Publications Office, 2000 P St., N.W., Washington 6, D. C.

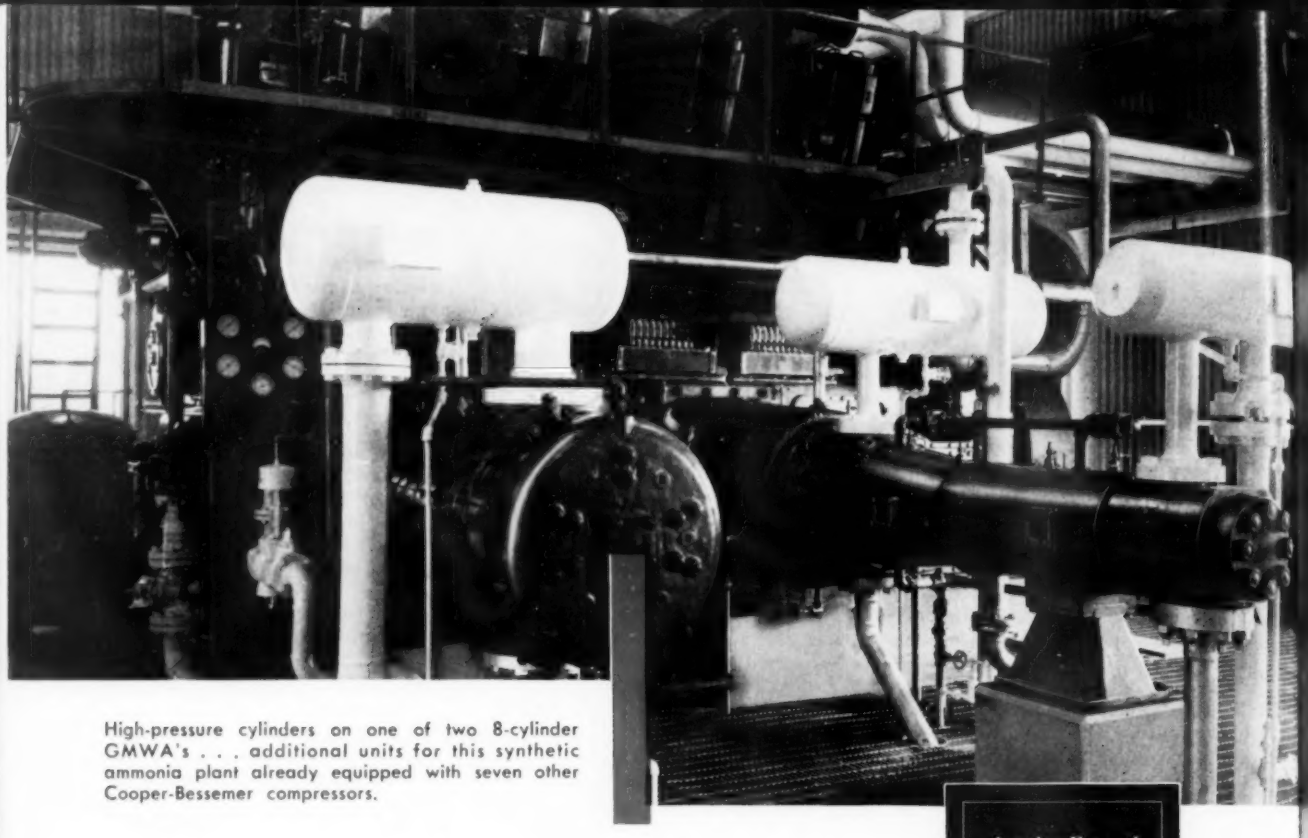
. . . reports of selected articles published in about 1000 European technical journals. They are intended to disseminate productivity ideas to a broader audience. All reports have been translated, when necessary, for an English and a French edition.

Significance of ASTM Tests for Petroleum Products, Special Technical Bulletin No. 7-B, 1955, 134 pp., 6x9, heavy paper cover, $2.50, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

. . . a general outline of how tests of performance characteristics are made and how they are significant for use of the petroleum products. Includes discussion of volatility, combustion, oxidation, flow and solidification, and corrosion characteristics. Written in relatively untechnical language.

ASTM Manual for Rating Motor Fuels by Motor and Research Methods, 192 pp, 6 x 9 in., hard cover, $6.75, American Society for Testing Materials, 1916 Race St., Philadelphia 3.

. . . up-dates ASTM methods for determining knock characteristics of fuels. Appendices carefully detail operation and maintenance of the knock testing equipment.



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Petroleum ENGINEERING

Glossary of Plastics

Plastics are substances of high molecular weight. They are solid in the finished state; but at some point in manufacture are soft enough to be shaped by heat and/or pressure.

Most plastics are produced by synthesis from natural resources such as water, air, coal, natural gas, etc. The exceptions are the cellulosics—chemically modified natural high polymers like cotton.

Two major types of plastics are made: **thermosets** harden into a permanent shape that cannot be changed; **thermoplastics** can be changed because they soften when heat is applied and harden again when cooled.

The following list of plastics, including both general types and *trade names*, are those apt to be found in refineries, natural gasoline plants and petrochemical plants.

This Plastic . . . (Trade name)	(Chemical name)	Made By . . .	Is Used For . . .	For These Properties:
Ace	chorinated rubber	American Hard Rubber	paints and lacquers	chemical resistance
Acrilan	acrylonitrile	Chemstrand Corp	clothing, elec. insul.	resistance to some acids
acrylics	polymers of acrylic acid or esters		window glazing, signs	clarity, transparency
Acrylon	polyacrylic ester	Borden Co.	a synthetic rubber	sunlight resistance
Agripol	polymerized veg. oils (no longer produced)	Reichold Chemicals	gaskets, tubing	a rubber substitute
Alathon	polyethylene	Du Pont	pipe, sheeting	inertness, flexibility
Alfane	epoxy resin	Atlas Mineral Products	mortar cement, hi-temp	acid resistance
Alkor	furan resin	Atlas Mineral Products	mortar cement, hi-temp	alkali resistance
alkyds	resins made from acids, alcohols		paints, lacquers	wearability, economy
allyl resins	polymers from allyl alcohol, dibasic acids		varnishes, adhesives	chemical-heat resistance
Alvar	polyvinyl acetal	Shawinigan Products	coatings, film	adhesion
Ameripol	synthetic rubbers	Goodrich-Gulf Chemical	hose, gaskets	
amino resins	urea-formaldehyde or melamine-formaldehyde		adhesives, coatings	resistant to mild acids
Ampcoflex	polyvinyl chloride	Atlas Mineral Products	pipe and fittings	corrosion resistance
Araldite	epoxy resin	Ciba Co., Inc.	electrical embedment	chemical resistance
Aropol	polyesters	Archer-Daniels-Midland	helmets, tote boxes	toughness
Atlac	polyester resin	Atlas Powder Co.	reinforced plastics	corrosion resistance
Atlastavon	polyvinyl chloride	Atlas Mineral Products	sheet lining, pipe	resists oxidizing acids
Bakelite	(many type plastics)	Bakelite Co.		
Beetle	urea-formaldehyde	American Cyanimid	adhesives, coatings	resistance to mild acids
Boltaron	polyvinyl chloride	H. N. Hartwell & Son	piping, ducts, hoods	corrosion-impact resistance
Butaprene	synthetic rubbers	Firestone Plastics		
Butvar	polyvinyl butyral	Shawinigan Resins	interlayer safety glass	adhesiveness and clarity
Butyrate	cellulose acetate butyrate	Eastman Chemical	pipe, tool handles	tough, light
Caprolan	polycaprolactam	Allied Chemical & Dye	filters, clothing	abrasion, chemical resistance
Catalin	(many plastics)	Catalin Corp.		
Celanese	(many plastics)	Celanese Corp.		
cellophane	cellulose film		film, sheeting	electrical insulation
Celluloid	cellulose nitrate	Celanese Corp.	film, tool handles	toughness
Cel-O-Seal	regenerated cellulose	Du Pont	sealing closures	resistance to oils, mild acids
Chemelec-300	polytetrafluoroethylene	United States Gasket	gaskets	resistance to chemicals, heat
Chemigum	butadiene-acrylonitrile elastomers	Goodyear Tire & Rubber	hose, gaskets, belts	resistance to oil, aromatics
Cibanite	aniline formaldehyde	Ciba Co., Inc.	grinding wheels	adhesiveness
Clorafin	chlorinated paraffin	Hercules Powder Co.	oil additive	corrosive action
Cycolac	styrene alloy	Marbon Chemical Div.	pipe, ducts, tote box	toughness, chemical resistance
Cymac	polymethyl styrene	American Cyanimid	instrument panels	heat resistance up to 212 F
Cymel	melamine resin	American Cyanimid	table tops, laminates	dimensional stability
Dacron	polyethylene terephalate	Du Pont	fire hose, ropes	resistance to chemicals, tensile strength
Dapon	diallyl phthalate	Ohio-Apex Div.	glass cloth	inertness
Dekoron	plastic coating	Samuel Moore & Co.	coating tubing	corrosion resistance
Devcon	Plastic-metal powder	Chemical Development	repairing, filling	hardens as a metal
Disogrin	elastomer of a polyester and diisocyanate	Greer Industries	O-rings, valve seals	resistance to oil
Distrene	polystyrenes	British Resins Prod.	pipe, covers	impact strength
Duralon	furan resin	U.S. Stonewares	cement, coating	resistance to acids

This Plastic . . .		Made By . . .	Is Used For . . .	For These Properties:
Durcon	epoxy	Duriron Co.	pumps, fans, valves	corrosion resistance
Durez	(several types)	Durez Plastics Div.	pumps, covers	weather and chemical resistance
Durite	phenol-furan, phenol-formaldehyde resins	Borden Co.	instrument cases	chemical resistance
Dylan	polyethylene	Koppers Co.	pipe, containers	corrosion, chemical resistance
Dylene	polystyrenes	Koppers Co.	electrical parts	lightness, inertness
Dynel	copolymer, vinyl chloride-acrylonitrile	Union Carbide & Carbon	clothing, filters	resistance to organic solvents
Ecco	epoxy resin	Emerson & Cumming	adhesives, cast dies	strength, inertness
elastomers	stretchable materials			flexibility
Elvanol	polyvinyl alcohol	Du Pont	hoses, gaskets	resistant to gases and solvents
Epon	polymer resins	Shell Chemical	coatings adhesives	durable, chemical resistance
epoxy resins	epichlorohydrin and bisphenol-A reaction		castings, laminates	low shrinkage, adhesion
Ethocel	ethyl cellulose	Dow Chemical	protective film	resists moisture
ethylene polymers			containers, pipe	flexibility, inertnes
Exon	polyvinyl resins	Firestone Plastics	pipe, coatings	resists corrosion
Fabricoid	pyroxylin-coated	Du Pont	belts, cases	toughness
Fairprene	elastomer-coated	Du Pont	gaskets, diaphragms	chemical resistance
Fluoroflex	polyfluoroethylene	Resistoflex Corp.	gaskets, tubing	heat-chemical resistance
Fluoroplast	polyfluoroethylene	U.S. Gasket Co.	gaskets	heat-chemical resistance
Fluoron	polyfluoroethylene	Stokes Molded Products	gaskets	heat-chemical resistance
Fluran	polyfluoroethylene	U.S. Stoneware	gaskets	heat-chemical resistance
foamed plastics	polyurethane isocyanate polystyrene polyvinyl chloride	including gases in liquid plastics as they cool or set	insulation, cushioning, sound absorption,	abrasion-resistance low moisture absorption insulating properties
Formica	melamine-phenolic laminates	Formica Co.	rods, tubes, sheets	durability, acid resistance
Formvar	vinyl formal resin	Shawinigan Resins	wire enamel, metals	adhesion, corrosion resistance
Forticel	cellulose propionate	Celanese Corp	goggles, tools	resists aromatics
Fortiflex	polyolefin	Celanese Corp.	tubing, containers	chemical resistance
Fostercast	polyester, cast	Westinghouse Corp.	skylights, tubs	heat resistance, weathering
furane resins	derived from furfural		cements, coatings	acid resistance
Gafite	polymethyl alpha chloroacrylate	General Aniline	glazing, cases	resistant to acids and alkalies
Gelva	vinyl acetate	Canadian Resins	coatings, sealers	adhesion, solubility
Geon	polyvinyls	B. F. Goodrich	hose, belting, gaskets	chemical resistance
Glidpol	polyester resin	Glidden Co.	coating, casting	strength, weather resistance
Glykon	polyester resin	General Tire & Rubber	castings, coating	resistance to corrosion
Glyptal	polyhydric alcohol and polybasic acid	General Electric	coatings	weather resistance
Grex	polyethylene	W. R. Grace	containers, liners	heat-moisture resistance
Haveg	many type plastics	Haveg Corp.	tanks, pipe, valves	acid, alkali resistance
Heresite	phenol-formaldehyde	Heresite & Chemical	electrical parts	impact resistance
Hetron	polyester	Durez Plastics Div.	ductwork, skylights	fire resistance
Hi-Fax	polyethylene	Hercules Powder Co.	containers, pipe	inertness, heat resistance
Hycar	synthetic rubbers	B. F. Goodrich Chemical	hose, gaskets, seals	resistance to oils, solvents
Hylene	isocyanates	Du Pont	making foamed plastics	adhesion, reaction
Hypalon	chlorinated polyethylene	Du Pont	gaskets, hose, liners	resists ozone, solvents, acids
Hysol	epoxy	Houghton Laboratories	adhesives, embedment	low shrinkage, impact
	vinyl plastisols	Houghton Laboratories	coatings	resists wear, chemicals
Indur	phenol-formaldehyde	Reilly Tar & Chemical	electrical parts	impact resistance
inorganic plastics	glass-bonded mica		electrical parts	temperature resistance
Insurok	phenolic sheets	Richardson Co.	gears, washers, tubes	impact resistance
Irrathene	irradiated polyethylene	General Electric	containers, pipe	heat resistance
isocyanates	polyurethanes		insulation, coatings	chemical resistance
Kel-F	polychlorotrifluorethylene	M. W. Kellogg Co.	packing, pipe, valves	inertness, heat resistance
Kodapak	cellulose acetate	Eastman Kodak Co.	packaging; electrical	toughness, insulation elec.
Korez	phenol-formaldehyde	Atlas Mineral Prod.	acid-proof cement	acid resistance, adhesion
Koroseal	vinyl chloride	B. F. Goodrich Co.	hose, covers, pipe	chemical resistance
Kralastic	styrene acrylonitrile polymer	Naugatuck Chemical	pipe, gears, wheels	toughness, resists chemicals
Krene	vinyl films	Bakelite Co.	tarpaulins, coatings	durability, lightness
Laminac	polyester resins	American Cyanimid	tanks, boats	reinforcement of glass fibers
Lemac	vinyl acetate	Borden Co.	coatings, sealers	adhesion, solubility
Lemol	vinyl alcohol	Borden Co.	hose, gaskets	resist oils and gases
Lucite	methyl methacrylate	Du Pont	signs, lights	light transmission, impact strength
Lustrex	polystyrene	Monsanto	tile, cabinets	dielectric strength, hardness

Note: Names of plastics in italics are *trade names.*

PERSONALS

Robert N. Johnson has been made chief technologist of the Tidewater Oil Co.'s Avon refinery. He succeeds **Harold J. Maddock,** who has been transferred to the electronic data processing study group with offices at the refinery.

Mr. Johnson

Johnson was graduated from the University of Washington in 1944 with a B.S. in chemical engineering. He joined Tidewater as a junior chemist at Avon in 1946. His last assignment was as operating foreman of the solvent and light oil treating plants.

In the New York divisional office of Tidewater **Dr. Harold E. Achilles** has been named assistant manufacturing coordinator. He was previously technical service supervisor of the research department, a post he has held since 1944.

At the company's new Delaware refinery the following supervisory appointments have been made:

C. A. Phillips, from chief refinery engineer at Drumright, Okla., to supervisor of the desulfurizing and hydrogen area.

Robert C. Harms, from the new refinery's advisory group to general coordinator of zone 1.

George E. Rohrmann, from the Avon refinery to general coordinator of zone 3.

John J. Dudowicz, from the advisory group working with the refinery's general contractors to electrical coordinator.

Samuel E. Roth, from the manufacturing and engineering department of the New York headquarters to instrumentation coordinator.

George S. Lee, from the recently closed Bayonne refinery to night superintendent.

T. Northcutt, James S. Whittey and **George N. Haines** were all shift foremen at Avon and are now night superintendents at the new refinery.

Dr. John W. Bertetti has been appointed vice-president in charge of manufacturing of Amoco Chemicals Corp., in Chicago, the company formed through consolidation of three chemical affiliates of Standard Oil Co. (Ind.)

Bertetti has been general manager of manufacturing since 1952 and a director of Pan-Am Southern Corp. since 1954. A graduate in chemical engineering from the universities of Illinois and Michigan, he worked first in research with both Indiana Standard and Pan American Refining Corp. Next he was with Root Petroleum, and in 1950, shortly before Root became part of Pan-Am Southern, he became refinery manager at El Dorado. He was moved to New Orleans and made assistant general manager of manufacturing in 1951.

P. W. Judah, manager of the lubricating department of Socony Mobil Oil Co. since 1952, has been appointed manager of the newly formed petroleum chemicals department. The group will act as a clearing house for petrochemical activities of the company.

Lloyd E. Lundahl has been named chief engineer and assistant maintenance superintendent for Great Northern Oil Co., Pine Bend, Minn. During the past two years he has been assistant chief engineer in charge of designs and construction of plant facilities for Grace Chemical Co., Memphis.

Previously he worked with Bechtel Corp. and Shell Chemical Corp.

Robert Wilson and **Wheeler G. Lovell** were awarded Certificates of Appreciation for fundamental research at the annual meeting of the American Petroleum Institute. Wilson is chairman of the board of Standard Oil Co. (Ind.), and Lovell is director of chemical research at Ethyl Corp.'s Research Laboratories in Detroit.

R. H. Smith has been named general superintendent of vinyl-vinylidene chloride and perchloroethylene in the Dow Chemical Co.'s Texas Division. He replaces B. G. Caldwell, who has transferred to the Louisiana Division. He is a 1940 graduate in chemical engineering from the University of Texas.

R. M. Davis, Jr., superintendent of glycol at plant B has been named general superintendent of gylcolsdichloride in the polyhydric chemicals department. He took his chemical degree at Texas A. & M. College in 1941.

M. D. Havlik has been named superintendent of glycol 3 and **L. D. Bacica** assistant superintendent of glycol 2. Havlik holds a degree in mechanical engineering that he received from Texas A. & M. in 1942. Bacica received his chemical engineering degree in 1952 from Texas A. & M.

Frank B. Odasz has been promoted to manager of development and control at Husky Oil Co. He was formerly assistant director of technical service. His new responsibilities place him in charge of chemical and statistical development and quality control.

Odasz is a graduate of Brooklyn's Polytechnic Institute and did graduate work at the University of Michigan. His B.S. and M.S. in chemical engineering were received from the Brooklyn school.

Patricia Helen Moyer has joined the organic chemical technical staff of the B. F. Goodrich Research Center, Brecksville, Ohio. She was previously with Phillips Petroleum Co. research department at Bartlesville and the Clevite Research Center in Cleveland. She received her Ph.D. in organic chemistry from the University of Wisconsin in 1954.

Mr. Herget

Mr. Parker

Walter T. Herget has been appointed to the new position of manager of operations in the manufacturing department of American Oil Co. He was previously general superintendent of the company's new Yorktown, Va., refinery. Another new post, assistant manager of operations, has been filled by **H. A. Parker,** formerly technical director of the Destrehan, La., refinery. Both men are headquartered in New York City.

Herget will be succeeded as assistant manager at Yorktown by **Brady V. Tunnell,** whose job of superintendent of the operating department has been given to **Guy L. Honeycutt.** Honeycutt was last general operating foreman at Yorktown.

The two new jobs have been created to assist the general manager of

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manufacturing in the coordination and expansion of the six refineries that will be part of Amoco after its merger with Pan-Am Southern Corp.

Herget was helping the Yorktown refinery manager to staff and train permanent employes since the groundbreaking in August of 1955. He joined the company's research and development department in Texas City in 1942 and in 1947 became head of a chemical department.

Parker began as a process design engineer at the Whiting refinery of Standard Oil Co. (Ind.) in 1944. He was made group leader in 1946 and transferred to Pan-Am's Destrehan refinery as technical director in 1951.

Tunnell, a graduate of the University of Texas, has had 16 years of company service. Honeycutt, also a Texas graduate, has been with the company for 17 years.

David W. Young has been appointed research associate of Sinclair Research Laboratories, Harvey, Ill. He joined the company last year after more than 20 years of research in petroleum. He received his B.S. and M.S. degrees from the University of Kentucky. He was with General Chemical Co. from 1936 to 1940, and with Esso Research and Engineering Co. from 1940-55.

Mr. Young

He holds 150 patents in petroleum and petrochemicals.

Two men were transferred recently to the Cincinnati refinery of Gulf Oil Corp. **Lawrence L. Laster** has been named manager of operations. **William S. Reeder** has become the refinery's manager of engineering.

Laster's last permanent assignment was as superintendent of the Pittsburgh refinery. When it was closed in 1954 he returned to Port Arthur and was assigned to special projects.

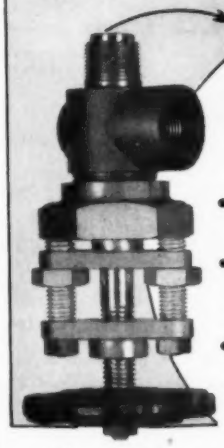
Reeder was appointed chief field engineer at Port Arthur in 1954.

Karl W. Shimeall, vice-president for refining of Crown Central Petroleum Corp., has been elected vice-president of the corporation in charge of Southwestern operations.

Shimeall's successor in refining is **Richard T. Colquette,** who has taken early retirement from Pan-Am Southern Corp., where he was vice-president of manufacturing.

New!

Jerguson Drain or Sampling Valve



- completely self-draining
- withstands severe conditions
- foolproof operation

¾" size shown

The new Jerguson No. 23 Drain or Sampling Valve is completely self draining, for the valve stem seats on the outside of the valve body. It is ideal for installations where it is desirable to have the valve seat inside the wall of a vessel in order to prevent the typical condition of liquid remaining in the nipple and valve inlet.

This rugged, new Jerguson Valve has outside screw and yoke construction to meet high temperature or corrosive conditions where inside threads cannot be tolerated. The efficient outside thread design eliminates possible freezing and allows the valve stem to work freely at all times. The No. 23 Valve provides foolproof operation because the stem is constructed with a left-hand thread, thus allowing the valve handle to operate in the normal direction of standard valves.

Available in sizes from ¾" to 2" N.P.T. ¾" and 1" sizes are recommended for pressures of 4000 lbs. @ 100° F. and 1000 lbs. @ 750° F.; 1¼, 1½ and 2" sizes are recommended for 600 lbs. @ 100° F. and 250 lbs. @ 750° F. Optional features include construction with additional outlet for such uses as a steaming out connection and with a reamer on the end of the stem to break away encrusted matter which may have collected on the inside vessel wall.

Write for data unit and complete details.

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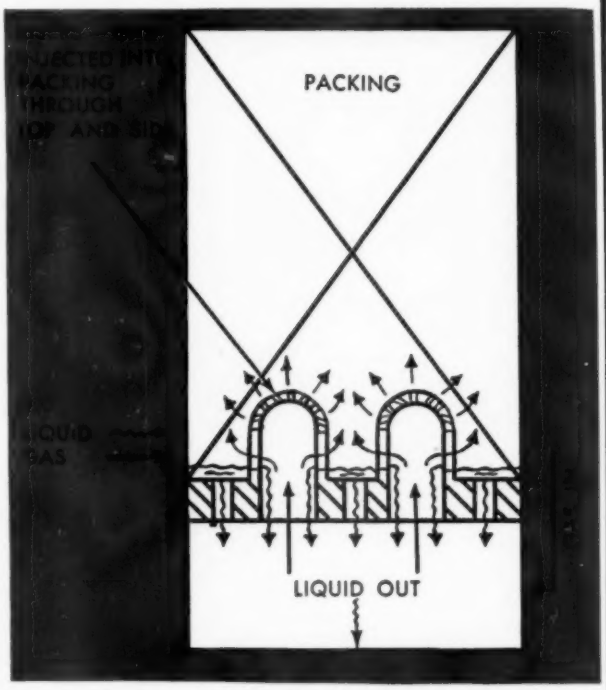
WEIR-TYPE SUPPORT PLATE* IMPROVES PERFORMANCE OF ANY DUMPED TOWER PACKING

The lower pressure drop expected from a high bed voidage can be quickly dissipated by restrictions to gas and liquid flow, set up by a limiting free area in the packing support plates.

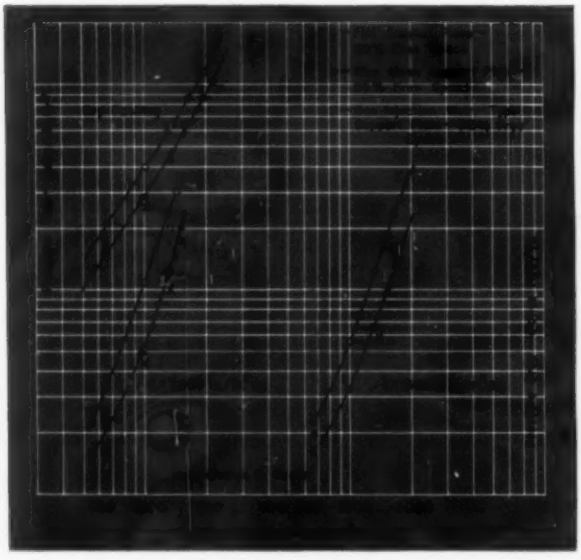
Conventional flat ceramic support plates have an actual free area of 20-30%. *Effective area,* however, is usually much less, because dumped packings, particularly in the smaller sizes, tend to block the openings in the plates.

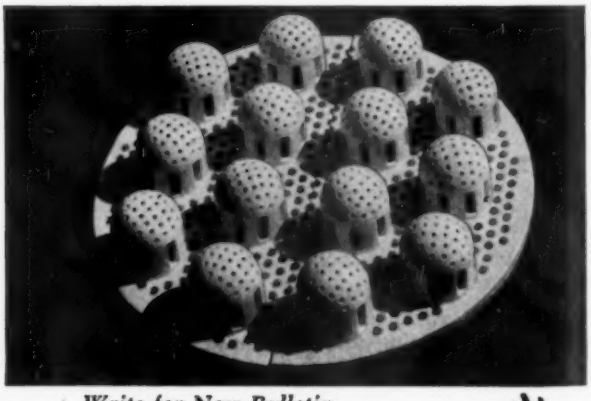
To approximately equal the voidage ordinarily encountered in a packed bed, a support plate must have a free area better than 50%, *under actual operating conditions.*

The weir-type support plate, in every size from 12″ diameter up to 60″ diameter, has better than 50% free area. Its unique, patented design minimizes any tendency of the packing to block the plate openings. Its high mechanical strength provides ample support, and, of course, its chemical porcelain body is completely acid-and-corrosion-resistant throughout (except for hydrofluoric acid and hot caustics).



In operation, the gas is actually injected or distributed into the column through the perforated hemispherical caps and through the upper portion of the slots in the risers. A major portion of the liquid ordinarily leaves the column through the openings in the base plate, but should these openings prove insufficient, and a slight head form, the overflow will escape through the bottom half of the slots in the risers.





Write for New Bulletin — on Weir-Type Support Plates

*U. S. Stoneware patent pending

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Tracerlab Offers "Package Deal"

Tracerlab, Inc., now offers reactor monitoring instrumentation and services as an expansion of its activities in the nuclear energy industry. The "package" includes sight surveys, selection and construction of monitoring equipment, health physics services, and training courses for people in reactor and fuel fabrication, waste disposal, and radio-chemical work.

One feature of the company's services is that standard components can be put together to build a system that meets individual requirements.

Airetool Builds Canadian Plant

A plant is being constructed in Brantford, Ont., to make Airetool Manufacturing Co.'s complete line of tube cleaners, tube expanders, and tube maintenance equipment. The plant will operate under the corporate name of Airetool Canada, Ltd., and manufacturing operations will begin early in 1957.

The bulk of products made in this new plant will go to Canadian oil refineries, chemical plants, and other types of facilities.

Du Pont Names Chicago Head

Carl W. Ferris has been made manager of the new Chicago district, central region, of Du Pont Co.'s petroleum chemicals division. The district includes Illinois, Indiana, Missouri and parts of Michigan, Iowa, Kentucky, Tennessee and Wisconsin.

Mr. Ferris

Mr. Ferris joined Du Pont in 1947 and worked at the Deepwater Point, N. J., petroleum laboratory. He was assigned to the central region in 1951 and has been an account manager working out of the Chicago regional office. Mr. Ferris is a mechanical engineering graduate of Cornell.

Kaiser Appoints Chief Engineer

Dr. George M. Fekula has been made chief process engineer of the refinery division of Kaiser Engineers, which is itself a division of the Henry J. Kaiser Co. He will supervise process engineering of refineries and petrochemical plants.

Dr. Fekula was formerly technical consultant on petroleum projects for the National Petroleum Council in Brazil. He also helped organize a new graduate school in Rio for training of petroleum refining engineers and technical management for Brazil's expanding petroleum industry.

Previously he was process design engineer for the California Research Corp. and, during World War II, was technologist and technical service engineer with Shell Oil Co. and Union Oil Co., respectively.

Dr. Fekula is a graduate of the University of Pennsylvania, class of 1937, and obtained his Ph.D. in chemical engineering at the University of Michigan in 1942.

GE Building Rotor Tester

An overspeed test facility for turbine and generator rotors is under construction at General Electric Co.'s Schenectady, N.Y., plant. The test plant will spin rotors at some 170 to 200% above normal speed in order to evaluate effect of severe operating conditions on their material properties and design features. The facility is expected to be operating in mid-1957.

Inside the test chamber the rotors will be spun through breakway couplings and gears attached to a 5000 HP turbine. A 1500 HP braking turbine will be used for deceleration purposes. Steam at 380 psig at 710°F will drive the turbines. The rotors will stand and be moved in and out of the chamber on a specially constructed type of railroad car.

The test building itself will be 175 ft long, 50 ft wide, and 30 ft high. Inside will be the concrete, cylindrical test chamber with an inside diameter of 16 ft. The cylinder walls will have 14 ft of reinforced concrete shielding, and a 1½ in. steel plate sleeve will line the chamber's inside walls.

M-H Buys Data Firm

Minneapolis-Honeywell Regulator Co. has purchased Davies Laboratories, Beltsville, Md., manufacturer of specialized high-speed data recording systems. The facility will be run by the company's industrial division in Philadelphia, which already produces industrial instrumentation.

High-speed data recording uses magnetic tape and is suited to situations in which a large volume of data must be recorded in a short time and made available for later study.

S&W Elects Connell V-P

Arthur J. Connell has been elected a vice-president of Stone & Webster Engineering Corp. He has been with the company since 1951 and has long been active in the petroleum, chemical and petrochemical fields.

Mr. Connell

After his graduation from Massachusetts Institute of Technology in 1927 he joined the E. B. Badger Co. in Boston. He became the firm's engineer in 1946, and in 1949 was elected a vice-president and director. The Badger firm in the U.S. was purchased by Stone & Webster in 1951.

Personnel Changes

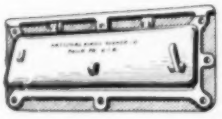
International Nickel Co.—Alden P. Edson to the New England technical field section. He is a metallurgist and was with company's research lab at Bayonne, N. J.; Charles M. Schillmoller to the West Coast technical field section. He was formerly with Richfield Oil Corp. as corrosion engineer. Both men are in development and research division.

Davison Chemical Co.—E. Kyle Ruble to midwestern district sales manager of the industrial chemicals division, supervising sales of silica gels, silicofluorides and other products; James W. Elston, staff assistant to the general manager of the petroleum catalysts division, has won the Marlin G. Geiger award for company employes. He is the first recipient of the award, which consists of $1000 and a medallion.

Warner Lewis Co.—Warner Lewis, Jr., to midwest zone manager in charge of the new office at 6642 W. North Ave. in Chicago. He was assistant sales manager of western U.S. sales. Company is a division of Fram Corp.

Tracerlab, Inc.—Paul Byrne to instrument division representative in northern California, Oregon, Wash-

A Complete Line of COMBUSTION ACCESSORIES for Every Industrial Liquid Fuel-Gas Installation



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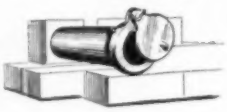
Fuel Oil Suction Strainer, single type. Large basket area insures low pressure drop; cover and basket easily removed for cleaning.

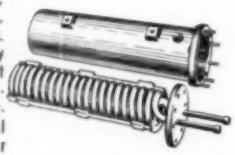
Wide-View Peephole, safety, curtain type. Cobalt glass removed to show bearing surface for curtain. Curtain halves are interlocked—open simultaneously.

Ignition Port with Refractory Tile No. M896 . . . for use with standard 3" pipe. Also serves as a peephole.



Furnace Relief and Access Door, heavy construction, practically air tight. Door casting correctly weighted, lined with plastic refractory retained by imbedded grill; with observation port and cover.

Fuel Oil Heater, Self-Cleaning, Spiral Coil Type. High oil velocity in coil, resultant turbulence prevents carbon formation. No internal connections or joints.



The "right combination" for you in achieving maximum combustion economy is: NATIONAL AIROIL Fuel Oil, Gas or Combination Oil & Gas Burning Equipment; NATIONAL AIROIL Combustion Accessories; and, NATIONAL AIROIL Engineering Consultation. May we be of help to you in accomplishing your particular installation or in solving that difficult problem?

CHEMICAL-PETROLEUM DIVISION

NATIONAL AIROIL BURNER CO., INC.

1297 EAST SEDGLEY AVE., PHILA. 34, PA.
Southwestern Division
2512 South Boulevard, Houston 6, Texas

INDUSTRIAL OIL BURNERS, GAS BURNERS, AND FURNACE EQUIPMENT

Suppliers

ington, Nebraska, Wyoming, Montana, Utah, and Idaho. Byrne will headquarter in Richmond, Calif.

B-I-F Industries, Inc.—Theodore R. Zatkovich from Pittsburgh sales to district sales manager in Chicago. He is a mechanical engineering graduate of the University of Pittsburgh.

Beckman Instruments, Inc.—James E. Tebay, sales engineer, has been transferred to the Mountainside, N.J., office.

Oil Well Supply Division—Henry V. Kappel to area manager, refinery and pipeline sales at Tulsa. He has been with Oilwell since 1947 as district engineer, refinery and pipeline equipment sales.

Manning, Maxwell & Moore, Inc.—Walter A. White to sales engineer with the Chicago district.

E. H. Kellogg & Co.—Joseph T. Cummings to general manager of operations and sales. He was formerly with Paragon Oil Co. as manager of wholesale and export sales.

Southwest Research Institute—Winthrop M. Barnes to process engineer on the industrial economics staff. He will specialize in markets, production, process, and economic aspects of chemical, petrochemical and related industries. He was formerly manager of market development for R. M. Hollingshead Corp.

Stone & Webster Engineering Corp.—A. W. Pratt, chief engineer, process division, has become engineering manager of the London affiliate, E. B. Badger & Sons Ltd. His duties as chief engineer in the Boston office have been assumed by T. E. Casselman as acting chief chemical engineer.

Lunkenheimer Co.—Jack L. Green to Houston sales representative. He was formerly with Western Oil Tool and Manufacturing Co.; W. B. Garrison to sales representative in the Rocky Mountain region.

Emery Industries, Inc.—Robert F. Connelly to field salesman on the West Coast for the organic chemicals sales department. He was formerly with Bray Oil Co. and Shell Oil Co. in research and development.

Tex-Tube, Inc.—W. A. Sammis, Jr., to south Texas district manager with offices at 335 New Moore Bldg., San Antonio.

Branches, Distributors

Jones & Laughlin Supply Division has opened a new supply store in the Louisiana Gulf Coast sales district. Store is one mile east of limits of Morgan City, La., on highway 90. B. E. Trisler, formerly at the Lake Charles store, is manager; Loran W. Todd, formerly at Houma, La., is sales representative.

Librascope Inc., has appointed Barton Instrument Corp., Los Angeles, distributors of the Librascope line of pressure compensated totalizing devices for orifice measurements of fluids.

Parker Appliance Co. has made Swan Engineering & Supply Co. distributor of its tube and hose fittings and tube-working tools. Swan is at 3251 Fairfax Rd., Kansas City, Kan.

Hills-McCanna Co. has appointed Tidewater Supply Co. agents for its chemical metering and proportioning pumps and its force-feed lubricators in Virginia, North Carolina and South Carolina.

Bechtel Corp. has opened a branch office in Houston to serve as regional headquarters. W. E. Arthur, Gulf Coast representative and a vice-president of Bechtel International Corp., is now located at Houston. Offices are in the Texas National Bank Bldg.

Walter Kidde Constructors have opened a branch office at Baton Rouge, La., which will be directed by John H. Jurik, formerly assistant to the manager of the company's southwest division.

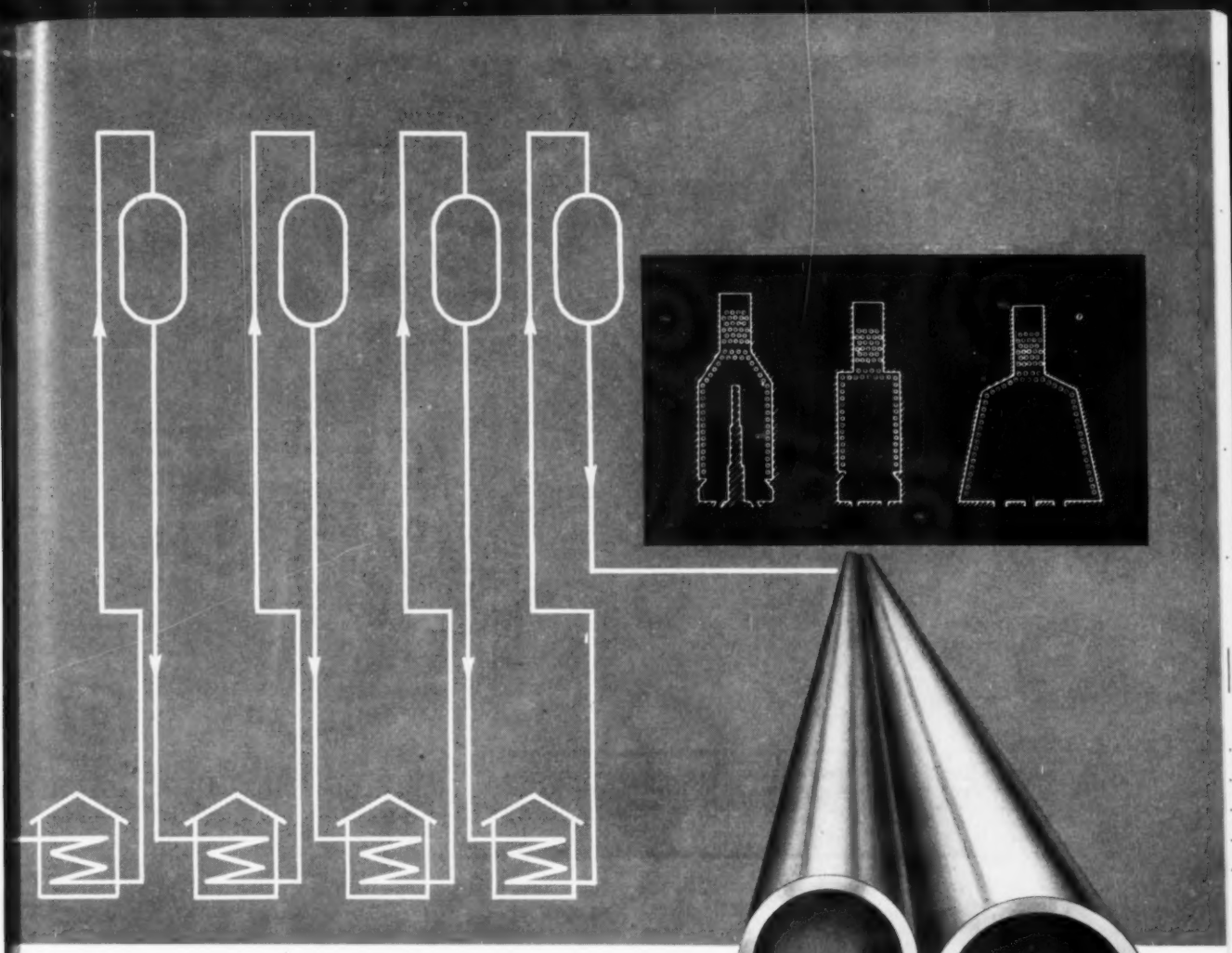
Hills-McCanna Co. has appointed R. S. Stover Co. sales agent for its products in Iowa, eastern part of Nebraska and northwestern Illinois.

Robertshaw-Fulton Controls Co. has named Continental Laboratories to represent the Fielden Instrument Division in Montana, northern Idaho and northern Wyoming.

Expansion, Transition

Erhart & Associates has relocated its San Francisco bay area engineering and construction offices at 444 Market St. in San Francisco.

Tube-Turns of Canada Ltd. has transferred its operations from Chatham, Ont., to 21 York St., Ridgetown, Ont.



HOW MANY PROBLEMS IN THIS PICTURE?

Some layouts present a multiplicity of engineering, purchasing, warehousing and financing problems. Conceivably, (1) Return bends have to be designed for a perfect fit on their heater tubes, (2) Both tubing and fittings must meet the same exacting customer standards, (3) Simultaneous delivery must be made to guarantee erection schedules, and (4) Money tied up in material in process at any one time must be kept to a minimum.

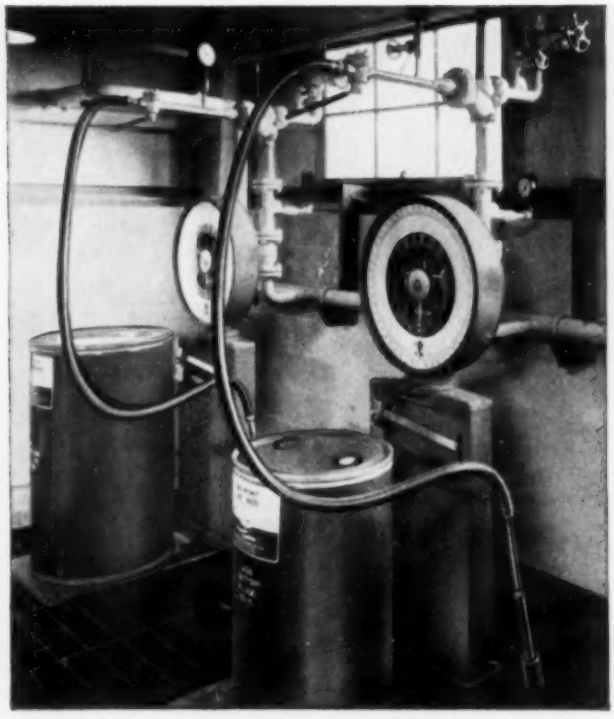
In such a situation, it's best to depend upon Mr. Tubes for coordinated delivery of perfectly matched tubing and fittings.

Think of your own requirements in terms of the right tube for the job, tubing (or alloy pipe) and welding fittings and forged steel flanges as components of an integrated system—and you'll make B&W's Mr. Tubes a member of your team. The Babcock &Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

B&W TUBULAR PRODUCTS DIVISION

TA-6085-PP

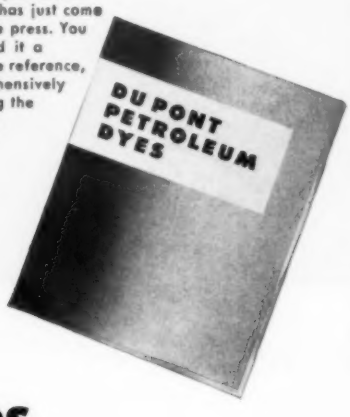
Seamless and welded tubular products, seamless welding fittings and forged steel flanges in carbon, alloy and stainless steels



NEW DU PONT dye drumhead has an opening through which new probe can be readily inserted and manipulated. The two developments increase efficiency, save both time and money and eliminate dusting in the dry-dye eduction process.

This is a close-up view of special opening which accommodates dry-dye eduction probe. Opening can be resealed with standard 2-inch pipe cap.

THIS BOOK on Du Pont petroleum dyeing has just come from the press. You will find it a valuable reference, comprehensively covering the subject.



Here are two more big reasons to use Du Pont dyes

New probe: Only six months ago Du Pont introduced an eduction probe of revolutionary design. It greatly facilitated the dry-dye eduction process, and solved the problem of clogging.

Now the same engineers who developed the probe have developed a new drumhead, also radically different from the conventional type, reducing dusting to an absolute minimum.

New drumhead: The drumhead, though removable, need never be taken off. It has a 2-inch circular opening just large enough for insertion of the probe. The small plastic disc sealing the opening can be easily removed with a pocketknife.

The drumhead opening is rimmed with plastic which is threaded to accommodate a standard 2-inch pipe plug. That means easy resealing to protect the quality which is built into all Du Pont dyes.

Petroleum dye book: A comprehensive book on the whole petroleum-dyeing subject has just been printed. It includes solubility charts, spectrophotometer curves, data on latest dyeing methods, and the use of the new probe and drumhead described above. Copies of the book, "Du Pont Petroleum Dyes," may be obtained from any of the sales offices listed below.

Product quality: Du Pont petroleum dyes are popular throughout the industry because of their outstanding qualities . . . uniformity, stability, solubility, purity and strength. Colors include red, yellow, blue, orange and bronze. These can be combined to produce other colors.

All Du Pont dyes have been proved to give excellent results in greases, motor and heating oils, jet and diesel fuels—as well as in gasoline where they have been most widely used.

Technical service representatives will gladly give you further information on any phase of the subject of petroleum-products dyeing. They will also be glad to help you install a dry-dye eduction system to fit your requirements.

DU PONT
REG. U. S. PAT. OFF.

Better Things for Better Living . . . through Chemistry

Petroleum Chemicals

Sales Offices: **E. I. DU PONT DE NEMOURS & COMPANY (INC.)** • *Petroleum Chemicals Division* • *Wilmington 98, Delaware*

CHICAGO 3—8 So. Michigan Ave. ..... RAndolph 6-8630
CLEVELAND 15—25 Prospect Ave. ..... SUperior 1-1363
HOUSTON 2—705 Bank of Commerce Bldg. ..... CApitol 5-1151
LOS ANGELES 17—612 So. Flower St. ..... MAdison 5-1691
NEW YORK 20—1270 Ave. of the Americas ..... COlumbus 5-2342
PHILADELPHIA 2—3 Penn Center Plaza ..... LOcust 8-3531
PITTSBURGH 22—Room 751, 1 Gateway Center ..... ATlantic 1-2933
SAN FRANCISCO 4—Room 626, 111 Sutter St. ..... EXbrook 2-6230
SEATTLE 3—Room 215, 4003 Aurora Ave. ..... MElrose 6977
TULSA 1—P. O. Box 730, 1811 South Baltimore Ave. ..... LUther 5-5578

IN CANADA: Du Pont Company of Canada (1956) Limited—Petroleum Chemicals—85 Eglinton Avenue East—Toronto 12, Ontario—HUdson 1-6461

OTHER COUNTRIES: Petroleum Chemicals Division—Export Sales—Room 7496 Nemours Bldg.—Wilmington 98, Delaware—OLympia 4-5121, Ext. 2962

Two-Stage Catalytic Reforming Process Gives . . .

Higher Gasoline Yields and Octanes

IN ANY naphtha reforming process, there is appreciable loss of gasoline, with this loss increasing as the severity of the operating conditions increases.

Gasoline loss during reforming is due somewhat to the increased density of the reformed products, but is mainly from substantial conversion of feedstock into gases, higher boiling products, and tar or coke. These losses are generally believed to be the result, directly or indirectly, of dealkylation, cracking and condensation.

For catalytic reforming, feedstocks in which the proportion of carbon atoms found in polymethylene rings is large are generally most amenable. However, if these naphthenic compounds have a large proportion of pentamethylene rings, reforming yield losses will be greater than if the proportion of hexamethylene rings is high.

Pentamethylene ring components in the feedstock cannot withstand the relatively drastic treating conditions of catalytic reforming without excessive cracking. Also, they are prone to be dehydrogenated to unsaturated products, such as cyclopentadiene, which undergo secondary reactions.

A single-stage catalytic reforming process, such as Platforming, which uses a promoted platinum-containing catalyst will substantially prevent dehydrogenation of pentamethylene rings (largely converting them to aromatics by dehydroisomerization) if the hydrogen partial pressure is sufficient.

The big stumbling block in the search for high aromatics yields is that the conversion of pentamethylene naphthenes into hexamethylene naphthenes, and the dehydrogenation thereof to aromatics, are equilibrium reactions.

Comparison of One-Stage and Two-Stage Catalytic Reforming of a Gasoline Fraction

Reaction Temp., °F	842			887			932		
Number Treating Stages	1(1)	1(2)	2(3)	1(1)	1(2)	2(3)	1(1)	1(2)	2(3)
C_5+ Yield, %	98.0	96.5	95.0	97.0	91.0	89.0	95.0	83.0	82.0
Aromatics, wt%	41	35	44	50	39	55	53	46	66
F-2 Octane Number	65	69	70	69	72	78	72	76	82

(1) One-stage method using 50 millilitres of commercial 100% nickel sulfide-tungsten sulfide catalyst.

(2) One-stage method using 50 millilitres of alumina-F-W-Ni (100-0.3-26.9-4.3) sulfidic catalyst.

(3) Two-stage method using 50 millilitres of first stage catalyst(1), and similar amount of second stage catalyst.(2)

By using a two-stage process (U. S. Patent No. 2,767,125—Shell Development Co.), hexamethylene naphthenes are converted into the more stable aromatics in a preliminary conversion stage, so that the second stage may concentrate on the dehydroisomerization of pentamethylene naphthenes into aromatics. These successive treatments prevent considerable quantities of hexamethylene naphthenes from being lost, either directly by hydrocracking, or by the same reaction after conversion into pentamethylene naphthenes.

The first stage of catalytic reforming uses a non-cracking type catalyst which can be either 0.1-1.0% platinum impregnated into pure silica, or a catalyst composed of a combination of tungsten sulfide and nickel sulfide on an alumina (not acid treated) carrier. In this stage, pentamethylene naphthenes are essentially unaffected, while the hexamethylene naphthenes are converted into aromatics.

In the second stage, the partially converted effluent from the first stage is treated either with or without intermediate separation of hydrogen. The dehydrogenation catalyst for the second stage is purposely promoted by an acid material. It can be of platinum on synthetic silica-alumina composites or alumina which have been acid treated, or on other types of cracking catalysts. Reactions in the second stage complete the catalytic reforming of the feedstock.

Operating conditions for the two stages are substantially the same, or can vary within the limits of 842-932°F, 435-1485 psig, 0.5-5 weight hourly space velocity, and hydrogen to hydrocarbon mol ratio of 3-10.

Comparison of gasoline yields and octanes for both single and double stage operation is shown in the table. These tests were on a gasoline fraction with a 235-376°F boiling range, F-2 octane number of 56, and containing about 25% aromatics, 49% naphthenes, and 26% paraffins. The treatment was at a rate of 2 kg per litre of catalyst per hour, with 1000 litres of hydrogen per kg of initial material, under a total pressure of 735 psig.

PROCESSES AND METHODS

FOR . . .	OF . . .	WITH . . .	ASSIGNEE . . .	PATENT NO. . . .
Addition	boron compound	gasoline & water removal therefrom	Standard Oil Co. (Ohio)	2,767,069
Alkylation	aromatics	olefin and PF_5	Standard Oil Co. (Ind.)	2,767,230
	olefins	alkali metal hydride cat.	Ethyl Corp.	2,769,800
Blending	gasoline	aromatics, alkylate, and paraffins	Socony Mobil Oil Co., Inc.	2,769,752
Carbonylation	olefins	CO & H_2 using cobalt catalyst	Esso Research & Engrg. Co.	2,767,217
	olefins	cobalt or nickel complex catalyst	Badische Anilin- & Soda Fabrik	2,768,968
	olefins	H_2 & CO & cobalt cat. (Oxo)	Esso Research & Engrg. Co.	2,768,974

(Continued on p. 116)

Patents (continued)

FOR . . .	OF . . .	WITH . . .	ASSIGNEE . . .	PATENT NO. . . .
Catalytic cracking	hydrocarbons	catalyst regeneration facil.	Gulf Research and Development Co.	2,767,126
	hydrocarbons	moving-bed catalyst	Sinclair Refining Co.	2,767,129
Catalytic reforming	gasolines	multi-stage process	Universal Oil Products Co.	2,768,126
	hydrocarbons	molybdenum oxide cat. & H_2	M. W. Kellogg Co.	2,768,933
	naphthas	simultaneous olefin formation	Phillips Petroleum Co.	2,767,124
	virgin naphtha	fluid Hydroforming system	Esso Research & Engrg. Co.	2,768,124
Coating	fine solids	fluidized-bed system	Shell Development Co.	2,768,095
Coking	hvy. hydrocarbons	fluidized coke particles	Esso Research & Engrg. Co.	2,768,938
Coking-desulf.	hvy. petroleum	fluid coking then hydrogen desulf.	Esso Research & Engrg. Co.	2,768,939
Color stabil.	lube oils	dist. using aldehyde	Union Oil Co. of Calif.	2,768,122
Combination	polyamide layer	polyvinyl chloride layer	Gulf Oil Corp.	2,770,665
Consumption	hydrocarbons	micro-organisms on adsorb.	Texaco Development Corp.	2,769,750
Conversion	hvy. hydrocarbons	granular contact mat'l.	Socony Mobil Oil Co., Inc.	2,770,582-3
	hydrocarbons	combined hydrodesulf.-cat. reform.	Pure Oil Co.	2,769,753
	hydrocarbons	molten catalyst in reaction zone	Universal Oil Products Co.	2,768,935
Cracking	hvy. hydrocarbons	moving-bed pebble heater	Phillips Petroleum Co.	2,767,130
Dealkylation	aromatics	thermal process	Esso Research & Engrg. Co.	2,768,219
Dechlorination	sulfurized olefins	polyhydroxy aliphatic org. compd.	Esso Research & Engrg. Co.	2,768,157
Decoloring	hydrocarbons	pyrrolidone	General Aniline & Film Corp.	2,767,119
Defluorination	organic material	catalyst & used HF	Phillips Petroleum Co.	2,769,853
Dehydration	aqueous acrolein	glycerol extraction process	Shell Development Co.	2,767,216
Desulfurization	hydrocarbons	BF_3 & solvent extraction	Sun Oil Co.	2,767,120
	mineral oils	organic polysulfide	Gulf Research & Development Co.	2,768,929
	petroleum dists.	Cu cat. in vapor-phase reaction	Esso Research & Engrg. Co.	2,768,932
	sour, hvy, dists.	aldehyde & acidic condensation cat.	Standard Oil Co., (Ind.)	2,768,936
Filtration	slurries	decreased liq. in filter cake	Shell Development Co.	2,768,120
Fluid coking	hvy. residues	volatile prod. rich in arom. & olef.	Esso Research & Engrg. Co.	2,768,127
Fractionation	feed stream	distillation system	Phillips Petroleum Co.	2,767,133
	liq. mixture	separation of methylethyl- & methylvinylpyridine	Phillips Petroleum Co.	2,769,773
Hardening	microcryst. wax	silica gel adsorption	Sun Oil Co.	2,767,205
Heating	solid reactants	radiant heating zone apparatus	Phillips Petroleum Co.	2,769,772
Hydrocracking	asphalts	arom.-naphthenic diluent & desulf. cat.	Esso Research & Engrg. Co.	2,768,936
Hydrodesulfurization	coker products	mixed liq.-gas phase react. in 2 zones	Esso Research & Engrg. Co.	2,769,754
	crude oils	removal of vanadium & sodium	British Petroleum Co. Ltd.	2,769,758
	Oxo alcohols	cat. forming metal carbonyl with CO	Esso Research & Engrg. Co.	2,767,222
	petroleum	trihydrate bauxite cat. support	British Petroleum Co. Ltd.	2,769,755-6
	unsat. dist.	hydrogen saturation & desulf.	Universal Oil Products Co.	2,770.578
Hydrogenation	carbon monoxide	precip. Cu cat. containing Fe & alkali	Ruhrchemie AG	2,767,202
	naphthenic gaso.	resultant anti-knock improvement	Shell Development Co.	2,767,125
Improvement	gaso. detonation	maleic anhydride treatment	Pure Oil Co.	2,769,766
	lube oil	sodium metal to give translucency	National Res. Council in Canada	2,767,122
Inhibition	corrosion	additive in dilute aq. HNO_3 solu.	Phillips Petroleum Co.	2,769,690
Manufacture	acetylene	feed of natural gas or methane	General Aniline & Film Corp.	2,768,223
	alkenyl pyridines	dehydrog. of alkyl pyridines	Phillips Petroleum Co.	2,769,811
	alkyl naphthenes	reaction of BF_3, cycloakyl fluoride & hydrocarbon	Sun Oil Co.	2,767,228
	alkylcycloparaffins	ethylene-cycloparaffin reaction	Universal Oil Products Co.	2,769,849
	aluminum chloride	reaction of aluminum & chlorine	Universal Oil Products Co.	2,768,070
	aromatic polymers	pyrolyzation of polymethyl benzene	M. W. Kellogg Co.	2,769,786
	asphalt	air-blowing of thermally cracked, vacuum reduced cat. cycle oil	Esso Research & Engrg. Co.	2,767,102
	benzene hexachloride	extraction of gamma-enriched isomer	Allied Chemical & Dye Corp.	2,767,223
	benzene hexachloride	removal of H_2O immisc. org. liq.	Pennsylvania Salt Mfg. Co.	2,770,658
	carbon black	elongated cylindrical chamber	Columbian Carbon Co.	2,768,067
	carbon black	thermal decomp. of hydrocarbons	Columbian Carbon Co.	2,769,692
	carbon disulfide	H_2S-CO-methane reaction	Stanolind Oil & Gas Co.	2,767,058-9
	catalyst	microspher. silica-alumina particles	W. R. Grace & Co.	2,768,145
	catalyst support	low Na content in act. alumina	Houdry Process Corp.	2,769,688
	chlorinated cmpds.	ethylene-carbon tetrachloride react.	Celanese Corp. of America	2,770,661
	copolymer	divinyl sulfide & unsat. monomer	Phillips Petroleum Co.	2,769,802
	cracking catalyst	siliceous hydrogel	Socony Mobil Oil Co., Inc.	2,767,148
	drying oil	butadiene-styrene reaction	Esso Research & Engrg. Co.	2,768,984
	drying oil	copoly. of butadiene & styrene	Esso Research & Engrg. Co.	2,767,229
	ethylene glycol	hydration of ethylene oxide	Dow Chemical Co.	2,770,656
	ethylene oxide	Ag catalyzed oxid. of ethylene	Jefferson Chemical Co., Inc.	2,769,016
	Fe biscyclopentadienyl	cyclopentadiene-Fe reaction	California Research Corp.	2,769,828
	fluid hydroform, cat.	molybdena & alumina	American Cyanamid Co.	2,768,125
	fluorocarbons	inorganic metal halide cat.	M. W. Kellogg Co.	2,770,660
	fuel oil	alkaline treat, for color stability	Socony Mobil Oil Co., Inc.	2,770,581
	gamma-chloropropyl-phosphonyl dichloride	react. of cyclopropane, PCl_3 & O_2	American Oil Co.	2,768,969
	gases	steam-combustion of solid fuels	Stanolind Oil & Gas Co.	2,770,536
	HCN	NH_3-hydrocarbon react. & Pt. cat.	Deutsche Gold- und Silber-Scheideanstalt	2,768,876
	high oct. gaso.	hydrocracking & hydroforming	Esso Research & Engrg. Co.	2,769,769

(Continued on p. 118)

—Photograph courtesy of Standard Oil Co. of N. J.

with Ljungstrom® Air Preheaters, four of your present stills can do the work of five

You'll have far less slag—much less downtime for maintenance—with the Ljungstrom Air Preheater. This unit produces more complete combustion, at higher temperatures, because preheated air mixes more thoroughly with fuel. And in addition, Ljungstrom efficiency makes possible finer process control and advanced furnace designs. Thus, Ljungstrom savings are real and measurable. One still, Ljungstrom equipped, added $58,000 of income annually from higher product quality alone.

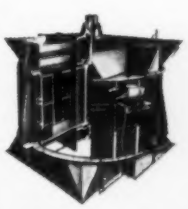
How fast is "WRITE OFF"?

Unusually short. Major savings are gained from higher average octane ratings. And other Ljungstrom advantages — up to 20% fuel savings . . . more economical furnace design, with no need for convection surfaces . . . use of many fuels you used to throw away . . . consistently higher throughput . . . shorter turnaround time—mean that a Ljungstrom is paid out in a very few months.

For more complete details on what the Ljungstrom Air Preheater can do for you . . . for an analysis of the heat recovery benefits attainable in fuel burning equipment—call or write the Air Preheater Corporation.

Wherever You Burn Fuel, You Need Ljungstrom

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.



The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

Patents (continued)

FOR . . .	OF . . .	WITH . . .	ASSIGNEE . . .	PATENT NO. . . .
	hydrazine	ammonia-toluene reaction	Sun Oil Co.	2,767,057
	hydrazine	denitrosopentamethylenetetramine hydrog.	M. W. Kellogg Co.	2,768,878
	hydrocarbon resins	C_8 polymeriz., hydrolysis & stripping	Esso Research & Engrg. Co.	2,770,613
	long-chain olefins	wax cracking using act. gamma alumina	California Research Corp.	2,768,225
	meta-alkyl tert.- butyl benzenes	tert.-butylating-alkylation conditions	California Research Corp.	2,768,985
	met. hydrocarbonyls	olefin, CO, and hydrogen reaction	Esso Research & Engrg. Co.	2,767,048
	olefin chlorohydrins	serially connected react. stages	Olin-Mathieson Chemical Corp.	2,769,845
	1,2,6-hexanetriol	cat. hydrog. of acrolein dimer	Shell Development Co.	2,768,213
	organic phosphate	unsymmet. trialkyl-tetrathio-o-prod.	Union Oil Co. of Calif.	2,769,831
	org. sulfur cmpds.	lube oil additive properties	Esso Research & Engrg. Co.	2,767,163
	oxygenated hydrocarbons	vapor-phase part. oxid. of satd. aliph. gases	Celanese Corp. of America	2,770,637
	oxygenated organics	react. with H_2 & CO_2 to increase yield	Stanolind Oil & Gas Co.	2,770,635
	phosphosulf. hydrocar.	catalyzing amount of peroxide	Esso Research & Engrg. Co.	2,768,999
	pitches	vac. dist. of cracked arom. oil	Phillips Petroleum Co.	2,768,119
	Pt.-alumina cat.	HF & sulfiding	Esso Research & Engrg. Co.	2,767,147
	resins	polyepox. & polycarbox. acid anhyd.	Shell Development Co.	2,768,153
	resins	reaction diolefin polymers & SO_2	Phillips Petroleum Co.	2,770,603
	s-hydrindacens	H_2 trans. react. on alkyl benzene	California Research Corp.	2,768,982
	solvent naphthas	hydrofin. reform., &/or molybdate treat.	Pure Oil Co.	2,769,757;9;60-4
	solvent naphthas	sodium treatment	Pure Oil Co.	2,770,579
	stable lube oil	adsorption & hydrogenation	Sun Oil Co.	2,767,131
	sulfur	continuous cyclic process	Texas Gulf Sulphur Co.	2,767,062
	alkyl thiophosphites	sour naphtha & alkyl mercaptans	Esso Research & Engrg. Co.	2,768,194
	unsat. alcohols	group II metal catalyst & alkanal	Shell Development Co.	2,767,221
	vinyl esters	acetylene-aliph. monocarboxylic acid	Monsanto Chemical Co.	2,770,650
Monitoring	gas-liquids systems	meas. of gas bubble sound vibrations	Food Machinery & Chemical Corp.	2,766,838
Operation	dual-fuel engine	variable vol. combustion chamber	Phillips Petroleum Co.	2,767,691
	piston engine	disc-shaped combustion chamber	The Texas Co.	2,767,692
Oxidation	hydrocarbons	contin. burning using gas. oxidant	Chemical Construction Corp.	2,767,233
Partial oxidation	hydrocarbons	oxygen-containing gas at 900°F	Stanolind Oil & Gas Co.	2,767,203
Polymerization	ethylene	alk. earth met. hydride & NiO cat.	Standard Oil Co. (Ind.)	2,767,160
	heterocyclic N_2 cmpds.	copper salt catalyst	Phillips Petroleum Co.	2,767,159
	olefins	phosphoric acid cat. particles	Esso Research & Engrg. Co.	2,767,234
Preparation	cat. cracker feed	distillation & solvent treat.	M. W. Kellogg Co.	2,770,576
Prevention	corrosion	inhibitor mixed with hydrocarbon	Sun Oil Co.	2,768,884
Purification	anthracene	dioxane solv. & crystallization	Phillips Petroleum Co.	2,767,232
	dialkyl aromatic	vapor-phase dealky. of trialkyl arom.	Sun Oil Co.	2,767,231
	gasoline distillate	hydrog. to remove S & N mat'l.	Universal Oil Products Co.	2,767,121
	heterocyclic N monomers	low-temperature separation	Phillips Petroleum Co.	2,768,169
	high MP waxes	formation of oil-in-water emulsion	Ernest Stossel	2,770,577
	tetrachlorobenzene	finely divided adsorbent clay	Ethyl Corp.	2,767,226
	oil sol. alcohols	extrac. of hydrocarbon contaminants	Stanolind Oil & Gas Co.	2,770,636
Reaction	hydrocarbons	HF-BF_3 agent on Al mat'ls.	Standard Oil Co. (Ind.)	2,768,983
Recovery	liqs. from gases	absorption & cooling	A. S. Parks	2,768,703
	vanadium	C & V contaminated cats.	British Petroleum Co. Ltd.	2,769,687
Regeneration	spent contact clay	solvent treatment	Texaco Development Corp.	2,769,751
Removal	arsenic from naphtha	ultra-violet light & cat. conv.	Universal Oil Products Co.	2,769,770
	mercaptans	alk. met. hydrox. wash of cracked oils	Esso Research & Engrg. Co.	2,769,765
Segregation	high & low boilers	superimposed low vel. flash zone	Esso Research & Engrg. Co.	2,768,940
Separation	acetylene	liquid absorption from gases	Monsanto Chemical Co.	2,770,323
	acidic gases-liqs.	aqueous amine solu. & electrolysis	Socony Mobil Oil Co., Inc.	2,768,945
	aromatics	extractive distillation	Houdry Process Corp.	2,768,131
	aromatics	Ag salt & alkane sulfonic acid	Standard Oil Co. (Ind.)	2,768,986
	benzene	diethylene glycol ext. from cat. ref.	Dow Chemical Co.	2,770,664
	benzene hexachloride	recov. of alpha & Gamma isomers	Hooker Chemical Co.	2,767,224
	C_8 aromatics	solid complexing agent	Union Oil Co. of Calif	2,769,851
	ethylene	partial liq. of gaseous mixture	M. W. Kellogg Co.	2,769,321
	fluids	fractionation system	Gulf Oil Corp.	2,769,309
	gaso. aromatics	aq. polyoxy-polyalkylene glycol	Universal Oil Products Co.	2,770,663
	naphthenic acids	alkaline treat. of lube oil vapors	Sun Oil Co.	2,770,580
	organic acids	ext. from hydrocarbon mixtures	Pure Oil Co.	2,769,767-8
	organic substances	adsorptive dist.	Shell Development Co.	2,768,942
	Oxo alcohols	distillation process	Esso Research & Engrg. Co.	2,768,981
	isoprene	heat soaking of C_4-C_{12} alkenes	Esso Research & Engrg. Co.	2,768,224
	liquids	adsorption-desorption process	Phillips Petroleum Co.	2,768,221
	xylenes	antimony trihalides	Shell Development Co.	2,768,220-2
	xylenes	fractional crystallization	California Research Corp.	2,769,852
Stabilization	acid sludge	addition of Oxo bottoms	Esso Research & Engrg. Co.	2,768,130
	hydrocarbons	heat in fractionating system	Black, Sivalls & Bryson, Inc.	2,768,118
	motor fuel	treatment for oxidation stab.	Esso Research & Engrg. Co.	2,767,123

(Continued on p. 120)

When you need...

Whatever the GRADE and the VOLUME of

NATURAL GASOLINE

Just rely on WARREN'S versatile facilities to give you dependable deliveries . . . WHERE and WHEN and the WAY *you* want them.

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Patents (continued)

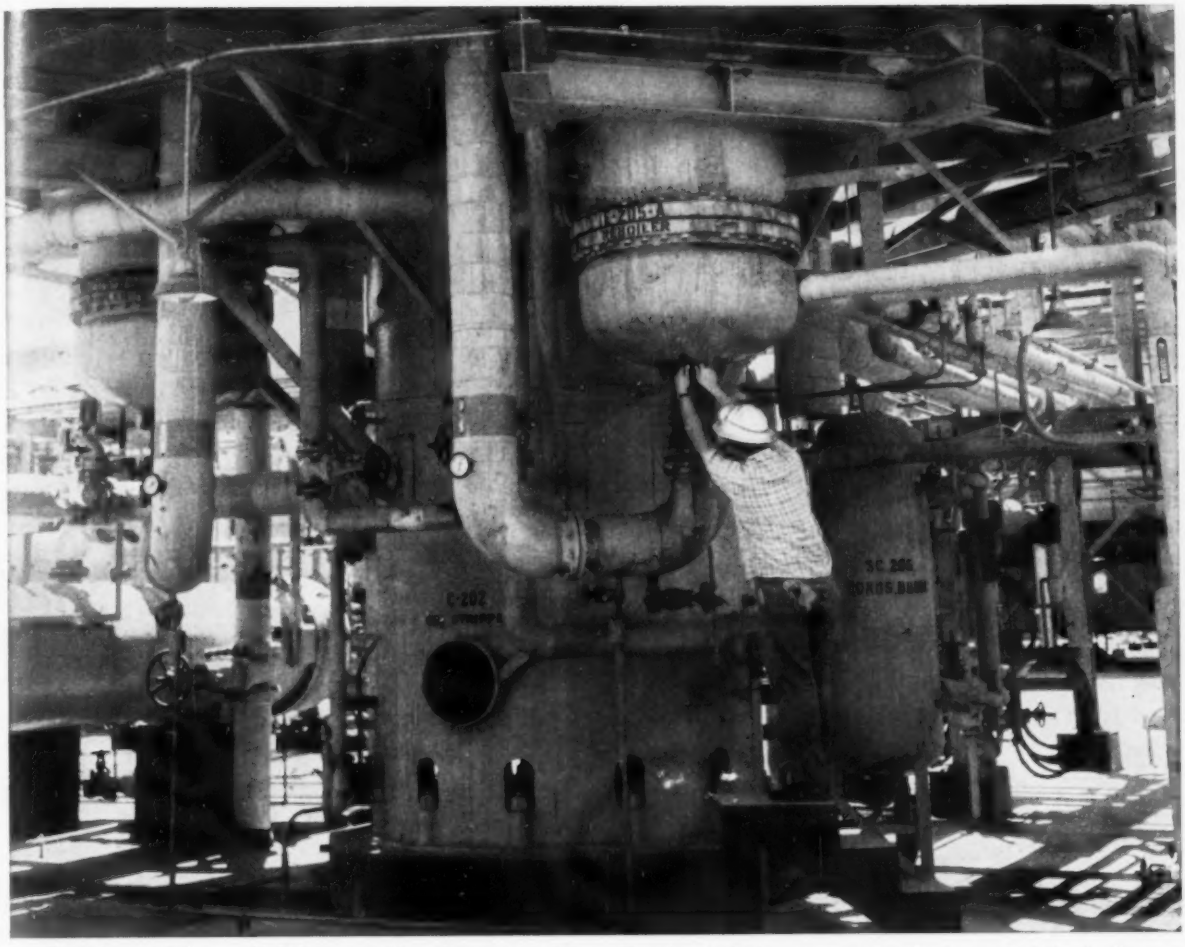
FOR . . .	OF . . .	WITH . . .	ASSIGNEE . . .	PATENT NO. . . .
	partly oxid. petrol.	H_2O_2 treat. for color stab.	Sun Oil Co.	2,767,204
Sulfonating	alkyl aromatics	refrigerated system	H. E. Luntz & D. O. Popovac	2,768,199
Sweetening	cracked naphthas	$CuCl_2$ cat. & phenylene diamine stab.	Standard Oil Co. (Ind.)	2,768,885
	petrol. dists.	alkali & lead sulfide cat.	Sinclair Refining Co.	2,768,931
Synthesis	aromatics	H_2-CO catalytic reaction	Standard Oil Co. (Ind.)	2,768,961
Telomerization	halogenated cmpd.	sulfuryl halide	M. W. Kellogg Co.	2,770,659
Treating	sec. alkyltoluenes	HF-BF_3	Standard Oil Co. (Ind.)	2,770,662
	granular mat'ls.	gases using moving solids bed	Ruhrchemie AG	2,766,534
	hydrocarbons	immiscible reagents	Esso Research & Engrg. Co.	2,768,123
Upgrading	hydrocarbon	iodine &/or HI followed by hydrog.	Socony Mobil Oil Co., Inc.	2,768,121

PRODUCTS

Alkylate	phenol	anti-oxidant properties	Esso Research & Engrg. Co.	2,769,784
Asphalt blend	asphalt	polymeric vinyl ether	Esso Research & Engrg. Co.	2,769,790
Catalyst	titania-Fe oxide	olefin hydration properties	Imperial Chemical Industries Ltd.	2,769,847
Chemical Product	phosphorus trihalide	perhalocarbons-Al-trihalide complex	Shell Development Co.	2,768,956
Coating	materials	butadiene polymer	Esso Research & Engrg. Co.	2,768,908
Coke	wax	opposite concave & convex surfaces	Sun Oil Co.	2,767,132
Copolymer	fluorethylene	perfluorochloroethylene	M. W. Kellogg Co.	2,770,605-6
Corrosion inhibitor	acid ester	dimeric acid	Gulf Oil Corp.	2,767,144
Diester	acyloxy radical	3-acyloxy-3-1,2,3,6-tetrahydrophthalic acid	Shell Development Co.	2,768,155
Fungicide	emulsifying agent	N,N,N'—trihydrocarbyl-S-hydrocarbyl isothiourea	Shell Development Co.	2,768,110
Grease	lube oil	alkali met. & alk. earth met. soaps	Esso Research & Engrg. Co.	2,768,139
	lube oil	complex basic aluminum soap	California Research Corp.	2,768,138
Hydraulic fluid	lubricant	high deterg. & anti-friction prop.	Esso Research & Engrg. Co.	2,768,953
Lube additive	reaction	metal alkyl phenol sulfide & P_2S_5	Esso Research & Engrg. Co.	2,769,782
	alk. earth met. salt	primary aliphatic amine salts	Gulf Oil Corp.	2,767,165
Lubricant	lube oil	anti-oxid. & ext.-press. additives	Shell Development Co.	2,767,142
	lube oil	metalo-organic additive	The Texas Co.	2,767,143
	lube oil	oxidation inhibitor	Esso Research & Engrg. Co.	2,768,129
	lube oil	polymer additive	Standard Oil Co. (Ind.)	2,768,954
	lube oil	polymer condensation product	Esso Research & Engrg. Co.	2,769,783
	lube oil	sodium alkyl phenate color stab.	Shell Development Co.	2,768,140
Perm. antifreeze	polyhydric alcohol	corrosion inhib. & anti-foam agt.	The Texas Co.	2,768,955
Repelling	insects	cumene hydroperoxide	Phillips Petroleum Co.	2,768,926
Soluble oil	mineral lube oil	various alkali metal soaps	Sun Oil Co.	2,770,594-8

EQUIPMENT

Alkylation	hydrocarbons	long horizontal cylindrical vessel	Standard Oil Co. (Ind.)	2,768,987
Analysis	engine misfire	electronic apparatus	Standard Oil Co. (Ind.)	2,766,616
Cat. reaction	reactants	elong. press.-retaining met. vessel	Union Oil Co. of Calif.	2,768,882
Computation	polynomials	mechanical apparatus	Phillips Petroleum Co.	2,767,909
Contacting	gas-fluid solids	use of chains in fluidized bed	Esso Research & Engrg. Co.	2,769,771
	liquids	perforated bubble tray	Stone & Webster Engrg. Corp.	2,767,966
	liquids	reciprocal dispersion contact zones	Shell Development Co.	2,767,068
	liquids	successive plates in column	Esso Research & Engrg. Co.	2,768,091
	solids-fluids	moving-solids bed	Houdry Process Corp.	2,767,128
Contin. combust.	liq. fuels	air flow & turbulence control	Phillips Petroleum Co.	2,770,096
Detection	leaks	pump shut-down control	Phillips Petroleum Co.	2,769,395
Elevation	gran. mat'l.	pneumatic lift	Socony Mobil Oil Co., Inc.	2,770,584
	gran. mat'l.	gas lift conduit	Socony Mobil Oil Co., Inc.	2,769,672
	gran. solids	gas lift conduit	Sun Oil Co.	2,767,031
Filling	LPG tanks	automatic valve assembly	H. H. Clute	2,767,552
Heat exchange	fluids	compartments for select. cleaning	Foster Wheeler Corp.	2,766,968
	solids-liquids	fluid catalytic cracking system	American Oil Co.	2,768,934
	solids-liquids	pebble heater apparatus	Phillips Petroleum Co.	2,769,693
Heating	fluids	furnace tubes in radiant zone	Universal Oil Products Co.	2,768,614
Indication	liq. interface	vertical conduit having float	Standard Oil Co. (Ind.)	2,767,586
Injection	fuels into engines	piston operated apparatus	Texaco Development Corp.	2,768,615
Manufacture	sodium	cell having purification device	Ethyl Corp.	2,770,591
	urea prills	sparger pipe having orifices	Deere & Co.	2,770,008
Measurement	flow rate	capillary assemblies	Standard Oil Co. (Ind.)	2,769,336
	thickness	penetrative radiation detector	The Texas Co.	2,769,097
	viscous mat'ls.	dual-chamber apparatus	Internat. Ytong-Stabalite Co. Ltd.	2,770,395
Movement	catalyst particles	gas lift in conduit	Gulf Oil Corp.	2,767,127
Purification	crystals	heated vessel	Phillips Petroleum Co.	2,770,533
Reaction	liquids-gases	vapor preheater on reactor	Tennessee Prods. & Chems. Corp.	2,769,696
Sampling	combustion-deposit	insertion device	Standard Oil Co. (Ohio)	2,766,615
Selection	flow passages	multiple selector valve	Standard Oil Co. (Ind.)	2,769,459
Separation	dust	vertical conical vessel	Ruhrchemie AG	2,766,880
	immiscible liqs.	contact. vessel & draw-off system	Esso Research & Engrg. Co.	2,767,848
	liquids	thermal diffusion apparatus	Standard Oil Co. (Ohio)	2,767,849-50
Settling	fine solids	agitation in vertical vessel	Esso Research & Engrg. Co.	2,767,847
Switching	storage tanks	piping & valve system	Phillips Petroleum Co.	2,769,455
Withdrawal	contact solids	metered tubular conduit outlets	Houdry Process Corp.	2,769,694



Monel-protected . . . Reboilers on this column used for stripping CO_2 from monoethanolamine solutions at a Shell Chemical anhydrous ammonia plant contain Monel alloy tubes. Tubes have shown no significant corrosion in two years.

Little to do but turn the valves when MEA reboilers have Monel bundles

Shell Chemical checks CO_2 corrosion . . . descales only once in two years

This workman never had it so good.

Used to spend a good deal of time with the two reboilers on this column which strips CO_2 from "fat" monoethanolamine solutions. First he would dismantle one. Descale. Hook up again. Before long it was the other's turn. Every three to six months new tubes had to go in.

But that all stopped in 1954

Shell Chemical put in Monel* nickel-copper alloy tube bundles.

Since then, the reboilers have been descaled but once. What's more, deposits appear to contain no corrosion products . . . just stream precipitates. Tubes look like new . . . have never been replaced.

Take a leaf out of Shell Chemical's book

Inco's Corrosion Engineering Section will be glad to help you check into corrosive conditions within your MEA reboilers.

If Monel alloy is indicated for the tubes . . . and there's a good chance that it will be . . . put it in!

Then relax. Look at the meters. Turn a valve once in a while.

*Registered trademark

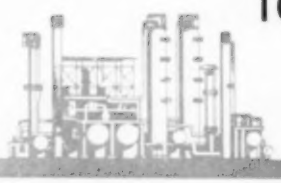
The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO Nickel Alloys
TRADE MARK

Monel . . . *for minimum maintenance*

(To obtain more data on advertised products see page 132)

Ready-made engineering staff for your custom-built plant...

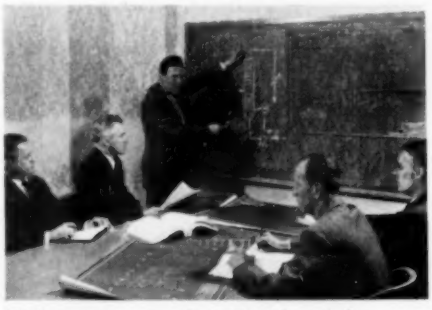


McKEE HAS THE ENGINEERS to design your plant—and the organization to build it—anywhere in the world. It's a ready-made staff composed of technical specialists in every field of engineering necessary for the complete design and construction of your new petroleum, petro-chemical or chemical processing plant.

More than half a century of experience has given us an unmatched fund of practical knowledge that is reflected in many cost-saving and time-saving advantages for you.

McKee engineers call on years of world-wide experience to solve plant design problems.

One of 15 specialized engineering groups in the McKee organization.



McKee engineers pool technical knowledge to assure correct design of your plant.

Ideal working conditions contribute to the efficiency of McKee engineers.

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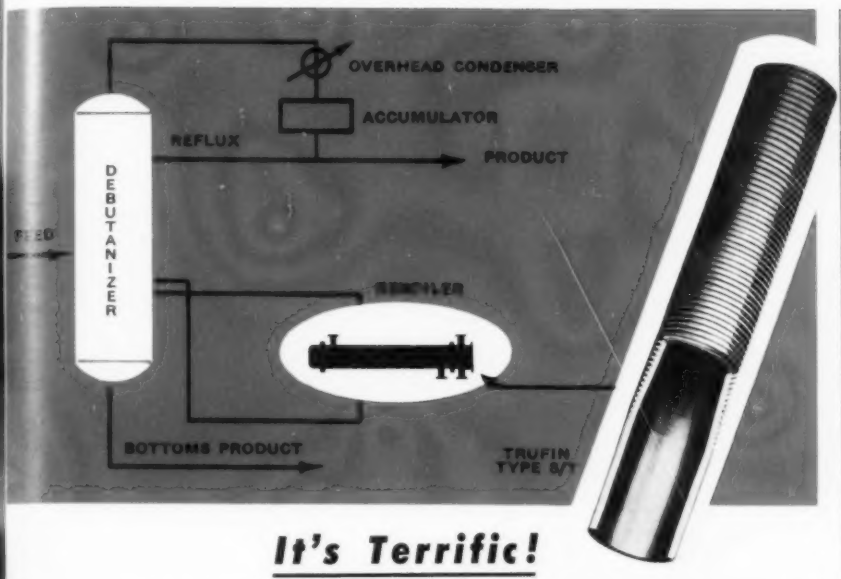
British Representatives of Metals Division: Head, Wrightson & Co., Limited
Canada: Arthur G. McKee & Company of Canada, Ltd., 372 Bay St., Toronto

(To obtain more data on advertised products see page 132)



It's Terrific!

ONE TRUFIN-TUBED DEBUTANIZER UNIT REPLACES TWO PLAIN TUBE REBOILERS

By Ernest Dodd

During a recent field trip I ran into an interesting heat transfer story. It has its setting in a large Midwest refinery and—after the facts had been assembled—here's the way it added up.

To obtain a heat duty of 2,382,000 BTU's per hour the refinery engineers had on stream two reboilers—one tubed with 407-¾" O.D. x 14 BWG x 16' long electric-welded steel tubes—the other with 348 similar tubes.

Now don't mistake me. There was nothing basically wrong with this installation. It was doing a good job and the engineers were happy with it—happy, that is, until they listened to a Wolverine technical sales representative who appeared on the scene just as the 348-tube unit came off stream for retubing. The man from Wolverine told his story and things will never again be the same around that refinery. Here's why!

The off-stream unit was retubed with 348 lengths of electric-welded steel Wolverine Trufin® Type S/T—the integral finned condenser tube. Because of the integral fins, Trufin Type S/T has double the heat transfer surface of plain tube. In addition to extracting more BTU's per foot of tube it also packs more heat transfer surface into a given area.

Because of this, *the single Trufin-tubed reboiler is carrying as much heat load as that formerly handled by the two prime surface units.* In the bargain the refinery engineers recently increased throughput in the column and the Trufin-tubed unit is still able to deliver the required heat duty.

There's a moral to this heat transfer story and it isn't hard to find: consult Wolverine's Field Engineering Service if you're looking for increased heat transfer performance. You'll boost production, cut costs, do a better all around job.

INTEGRAL DESIGN HELPS TRUFIN FIGHT VIBRATION

The fins of Wolverine Trufin are integral—squeezed directly from the tube wall. As a result there is no possibility of a "fin joint efficiency loss" because of vibration, thermal shock or varying pressures. The fins of Wolverine Trufin remain constant during the life of the tube.

In addition, the heavier gauge of the end section and the standard gauge of the finned tube results in a short length of tapered wall thickness and inside diameter. Because of this, the Trufin tube gives maximum rigidity at the end section where service stresses tend to concentrate. The smooth, gradual taper on the inside diameter has the additional feature of lessening turbulence which also helps increase Trufin's life expectancy.

Cuts Structural Weight

Because Wolverine Trufin packs more heat transfer surface in a given area it permits the design of smaller heat exchangers and condensers. As a result, where overhead units are used, the more compact, more powerful Trufin units require less structural support—a feature which often means substantial savings.

SEND FOR FREE BOOK

Probably the most comprehensive source of information available anywhere on finned condenser tubes is to be found in Wolverine's Trufin Opportunity Book. Here engineers will find valuable design information, fouling data and applications as well as many actual case studies. This book is yours absolutely—FREE! Write for your copy—TODAY!

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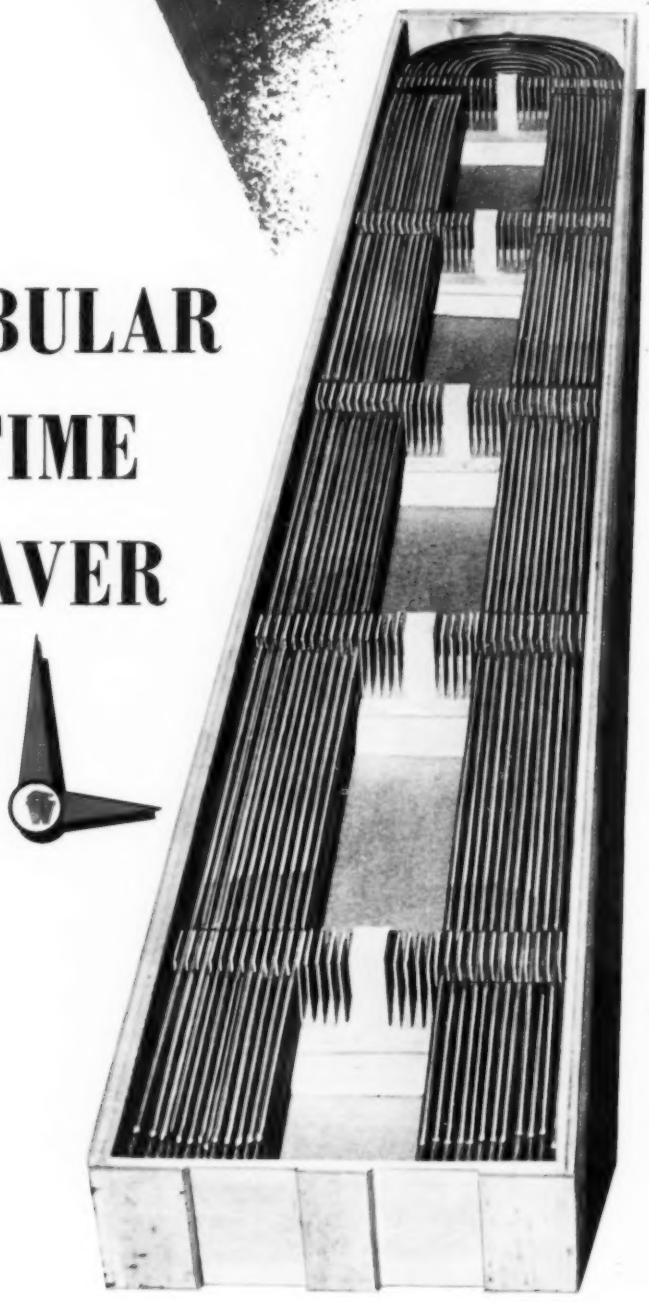
Wolverine Trufin available in Canada through the Unifin Tube Company, London, Ontario

TUBULAR TIME SAVER



Saving time is important—it is directly reflected in both output and financial earnings.

You can save time—lots of it—by using prefabricated Wolverine U-Bend condenser tubes in either finned (Wolverine Trufin®) or prime surface form.

Wolverine bends condenser tubes to your specifications—ships them in disposable box-type pallets in the exact order of their installation—ready for direct insertion into your heat exchanger or condenser.

In addition to assembly time, you eliminate the transportation, space and handling headaches present when dealing with tubes over 30 feet long. One tube sheet is eliminated and floating head problems are reduced. Rolling in operations are cut in half.

Wolverine prime surface tube U-Bends are available in a wide range of sizes and alloys in copper, copper-base alloys and aluminum. Capacity boosting Trufin U-Bends are available in copper, copper-base alloys, aluminum and electric-welded steel. Complete information is contained in Wolverine's Condenser Tube Catalog. Write today.

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First Details of API Mid-Year Meeting

SESSIONS on isomerization, reforming and handling of kerosine will be new features at the mid-year meeting of the American Petroleum Institute's Refining Division. In addition there will be sessions on analytical research, electrical equipment, corrosion, instrumentation and other topics of urgent interest to the petroleum processor. The meeting will be at the Sheraton-Philadelphia Hotel, Philadelphia, from May 13 to 16.

The preliminary program lists the following papers and authors where the sessions have been fully developed. Otherwise, subject titles are given:

Isomerization

"The Isomate Process," by someone from Standard Oil Co. (Ind.)

"Dehydrogenative Reforming of Low-Boiling Saturates," by A. Schneider, C. K. Donnell, Sun Oil Co.; D. H. Stevenson, Houdry Process Corp.

"Isomerization Adds to Your Octane Picture," by H. R. Crane, G. R. Worrell and J. Ozawa, Atlantic Refining Co.

"Isomerization by the Iso-Kel Process," by someone from M. W. Kellogg Co.

Isomerization and Reforming

"Hydro-isomerization by the Penex Process," by D. H. Belden and V. Haensel, Universal Oil Products Co., and W. C. Starnes and R. C. Zabor, Gulf Research and Development Co.

"High Octane Motor Blending Components from C_5 and C_6 Virgin Naphthas," speaker from Houdry Process Corp.

"Platinum Reforming on a Commercial Scale," by H. C. Nix, Humble Oil and Refining Co.

Handling Kerosine

"A report on the Program to Determine the Hazards Involved in Handling Kerosine," by a person from Cities Service Research and Development Co.

Corrosion

"Corrosion in Catalytic Reforming and Associated Processes (Panel Report of the Subcommittee on Corrosion, Committee on Refinery Equipment)," by E. B. Backensto, Socony Mobil Oil Co.

"Some Typical Cases of Corrosion in Platformers," by D. J. Bergman, S. A. Bjorkman, Universal Oil Products Co.

"Corrosion Control in Ultraformers," by A. Dravnieks and Carl Samans, Standard Oil Co. (Ind.)

"Hydrogen Attack of Steel in Refinery Service," by A. R. Ciuffreda, Esso Research and Engineering Co.

"Corrosion in Crude Processing—Low pH vs. High pH," by J. A. Biehl and E. A. Schnake, Ohio Oil Co.

Electrical Equipment

"Mineral Insulated (M.I.) Cable," by C. Jordan and T. J. Massar, General Cable Corp.

"Air-Break vs. Oil-Break Electrical Equipment for Use in Refineries," by L. T. Ellis and W. R. Morton, General Electric Co.

"Development and Design of Electrical Equipment for Use in Areas Defined as Class II in API Standard RP-500," by H. A. Wright, Allis-Chalmers Mfg. Co.

Analytical Research

"Spectrophotometric Determination of Nitric Oxide or Nitrogen Dioxide in Gas Samples," by Francis J. O'Hara and Orville N. Hinsvark, Girdler Co.

"Determination of Traces of Water in Reformer Charge Stocks and Products (Sample Handling and Interferences)," by J. West Loveland, Thomas B. Webster, Charles P. Hablitzel and George W. Reed, Sun Oil Co.

"Analysis and Biological Assessment of Petroleum-Based Insecticides," by A. D. Harford and E. Thornton, British Petroleum Co.

"Polarographic Estimation of Thiophenes and Aromatic Sulfides in Petroleum," by Harry V. Drushel and James F. Miller, Mellon Institute of Industrial Research.

"Rapid Chromatographic Analysis of Soap-Thickened Greases," by George W. Powers, Jr., and Frank J. Piehl, Standard Oil Co. (Ind.)

"Sequential Probability by Ratio Test as a Novel Statistical Procedure in Analytical Chemistry and Quality Control," by Bert L. Vallee, Harvard Medical School.

"A Rapid Method for the Determination of Zinc in Lubricating Oils," by T. L. Marple, G. Matsuyama, and L. W. Burdett, Union Oil Co. of California.

"Determination of Five to Seven Carbon Saturates in Petroleum by Gas Phase Chromatography," by F. T. Eggerston and S. Groennings, Shell Development Co.

"A Wet-Ash Spectrochemical Method for the Determination of Trace Metals in Petroleum Fractions," by J. Hansen and C. R. Hodgkins, Esso Research and Engineering Co.

"Determination of Trace Quantities of Hydrocarbons in the Atmosphere," by E. R. Quiram, Esso Research and Engineering Co.

"Determination of Bromine Number by Automatic Titration," by E. H. Unger, Socony Mobil Oil Co.

"Determination of Oil in Refinery Effluent Water (A Report of the API Subcommittee on Refinery Effluent Water Analytical Meth-

Oil Man's Calendar

(Boldface items reviewed in this issue)

JANUARY

14-18 Society of Automotive Engineers, annual, Sheraton-Cadillac and Statler Hotels, Detroit

17-18 Engineers Joint Council, annual, Statler Hotel, New York City

21-25 American Institute of Electrical Engineers, winter general, New York

23-25 Instrumentation for the Process Industries, symposium sponsored by Texas A. & M., College Station

28-30 8th Plant Maintenance and Engineering Conference, Statler, Cleveland

31-Feb.1 Sixth Annual Instrument Short Course, Southern California Meter Assn., Los Angeles Harbor Junior College, Wilmington, Calif.

FEBRUARY

4-8 American Society for Testing Materials, committee week, Franklin Hotel, Cleveland

8-9 Symposium on Composition of Petroleum Oils, API and ASTM subgroup, Jung Hotel, New Orleans

15-16 National Society for Professional Engineers, spring meeting, Hotel Francis Marion, Charleston, S. C.

22 Natural Gasoline Assn. of America, Permian Basin regional, Scharbauer Hotel Midland, Texas

MARCH

3-6 American Institute of Chemical Engineers, national meeting, Greenbrier Hotel, White Sulphur Springs, W. Va.

10-16 Nuclear Engineering and Science Congress, ASME etc., Philadelphia

11-15 National Assn. of Corrosion Engineers, annual, Kiel Auditorium, St. Louis, Mo.

18-21 Gas Turbine Power Conference, ASME, Sheraton-Cadillac, Detroit

25-27 Western Petroleum Refiners Assn., annual, San Antonio

27-28 Engineering Management Conference, ASME, Penn Hotel, Pittsburgh

APRIL

3-5 Corrosion Control Short Course, central Oklahoma Section of the NACE and University of Oklahoma, Extension Study Center, Norman, Okla.

7-12 American Chemical Society, national, Miami

8-10 American Society of Mechanical Engineers, spring meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala.

10-12 National Nuclear Instrumentation Conference, Instrument Society of America, Atlanta, Ga.

15-17 American Society of Lubrication Engineers, annual, Sheraton-Cadillac Hotel, Detroit

16-18 National Petroleum Assn., semi-annual, Hotel Cleveland, Cleveland

16-18 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman

24-26 Natural Gasoline Assn. of America, annual, Rice Hotel, Houston

29-30 Automatic Control in the Petroleum and Chemical Industries, University of Oklahoma, Norman

MAY

13-16 American Petroleum Institute, Division of Refining mid-year meeting, Penn-Sheraton Hotel, Philadelphia

JUNE

5-7 Pennsylvania Grade Crude Oil Assn., annual, Penn-Sheraton, Pittsburgh

9-12 American Institute of Chemical Engineers, national, Olympic Hotel, Seattle, Wash.

16-18 American Society for Testing Materials, annual, Chalfonte-Haddon Hall, Atlantic City

17-20 3rd Conference on Carbon, U. of Buffalo, Buffalo, N. Y.

ods of the Committee on Analytical Research)," by J. B. Rather, Jr., Socony Mobil Oil Co.

Air Pollution

"Further Developments in the Chemistry of the Atmosphere," by W. E. Scott, The Franklin Institute.

"Damage to Vegetation by Polluted Atmospheres," by John T. Middleton, University of California.

"Automobile Exhaust Gas—Its Contribution to Air Pollution," by C. M. Heinen, Chairman, CFR Group on Composition of Exhaust Gas; Chrysler Corp.

Fuels

"Factors in Designing Gasolines for Modern Engines," by C. A. Hall, H. A. Toulmin and T. W. Warren, Ethyl Corp.

"Road Octane Numbers of Tomorrow's Fuels in Tomorrow's Cars," by J. S. Bellah, J. J. Greytak and W. E. Morris, Du Pont Co.

"A Refinery View of Fuels for the Future," by Humble Oil and Refining Co.

Training

"The importance of Spiritual Values to the Well-Balanced Manager," by O. A. Ohrmann, Standard Oil Co. (Ohio).

"The Supervisor's Role in the Recognition and Adjustment of Problem Cases in the Refinery," (speaker unannounced).

Instrumentation

"Intrinsic Safety," by Lee E. Chucker, Fielden Instrument Co.

"Automatic Logging Equipment," (speaker unannounced).

The dinner session will be presided over by H. W. Ferguson, Vice-President for Refining of the API, who is with Humble Oil and Refining Co. Details of the session have not yet been announced and are being worked out by C. H. Thayer, Sun Oil Co.

California Meter Group Plans 6th Short Course

Flow, temperature and pressure regulation with pneumatic and electronic instruments will be taken up at the sixth annual instrument short course, to be given at Los Angeles Harbor Junior College, Wilmington, Calif. The course is jointly sponsored by the Southern California Meter Association and the college. It is to be held from January 31 to February 1. Following are titles of some of the papers to be read:

"Better Process Control Through the Use of Analytical Instruments and Computers"; "Fundamentals of Orifice Meter Measurement"

"Remote Tank Gauging"; "Viscosimeters"; "Applications for Analytical Instruments in the Process Industries"

"Fundamentals of Gas Displacement Meters"; "Integrating Orifice Meters"

"Liquid-Level Controllers—Float and Displacement Types"; "Infrared Spectrophotometer"

"Fundamentals of Pressure Regulation"; "Bellows-Type Orifice Meters"; "Air Monitoring Analytical Instruments"

"Fundamentals of Automatic Control"; "The Rotameter—a Primary Flow Element"; "Maintenance of Diaphragm Control Valves"

"Data Handling"; "A New Electro-Pneumatic Control System"; "Unusual Problems Related to Flow Measurement"; "Computer Applications"

"Specific Gravity—Its Significance and Determination"; "Maintenance of Mercury-Type Orifice Meters"; "Expansible-Tube Type Regulators"; "Temperature Measurement—Expansive and Thermoelectric"

"Problems in Field Measurement of Wet Gas"; "Gas Measuring Stations—Design for Maximum and Minimum Flow"; "McIlroy Fluid Network Analyzer"

ASTM-API Oil Symposium Final Details Released

FINAL program details have been released for the symposium on the composition of petroleum oils to be conducted by a subgroup of the American Society for Testing Materials on February 8 and 9. The meeting is to be sponsored by the Refining Division of the American Petroleum Institute, and the ASTM group involved is Research Division IV on Hydrocarbon Analysis, part of Committee D-2. The Jung Hotel in New Orleans will be the site.

Topics of the papers and authors are as follows:

SEPARATION

Volatility and Adsorption

Summary of work of the API Project 6 on the hydrocarbons in the C_{13} to C_{38} portion of petroleum, by Beveridge J. Mair and Frederick D. Rossini, Carnegie Institute of Technology.

Silica gel adsorption and other techniques employed in the determination of the paraffin, mono and dicyclic naphthene content in straight-run gas-oil fractions boiling between 590° and 770° F., by H. C. Rampton, Sunbury Research Station, British Petroleum Co.

Composition of an East Texas distillate, after hydrogenation and furfural extraction employing distillation and chromatography, followed by analysis by high mass spectrometry, by B. A. Orkin, Socony Mobil Oil Co.

Thermal Diffusion

New thermal diffusion techniques applicable to the separation of high boiling petroleum fractions, by A. L. Jones, Standard Oil Co. (Ohio)

Separation of high boiling petroleum oils by thermal diffusion, by F. W. Melpolder, Atlantic Refining Co.

Solvent Extraction

Solvent extraction and solution behavior. The application of correlations as supplement in the analyses of oil fractions, by E. L. Derr, Shell Development Co.

SPECTROSCOPIC METHODS

Infrared

Determination of methyl and methylene groups—discussion of techniques employed for the determination of aromatic contents of hydrocarbon mixtures, by R. H. Hughes and R. J. Martin, Gulf Research & Development Co.

Mass Spectrometry

Analysis of petroleum oils by mass spectrometry, by E. G. Carlson and M. J. O'Neal, Shell Oil Co.

Nuclear Magnetic Resonance

Nuclear magnetic resonance characterization of petroleum, by R. B. Williams, Humble Oil & Refining Co.

Influence of intermolecular interactions on nuclear magnetic resonance chemical shift measurements as related to certain high molecular weight hydrocarbon systems, by J. R. Zimmerman, Magnolia Petroleum Co.

GENERAL METHODS AND CORRELATIONS

Chemical Treating

Sulfonation-desulfonation and inspection of the hydrocarbon nuclei by elementary analyses, infrared and ultraviolet techniques before and after extensive hydrogenation, by J. O. Knoblock, Standard Oil Co. (Ind.)

Adsorption & Physical Property Methods

A comparison of carbon type composition of a number of oil fractions as determined by a detailed method and the various short-cut correlative methods, by S. S. Kurtz, Jr., Sun Oil Co.

Analytical Comparisons

Review and comparision of data by NMR, MS and ndM (with modifications) procedures, by S. H. Hastings, B. H. Johnson, H. E. Lumpkin and R. B. Williams, Humble Oil and Refining Co.

Molecular Weight Determination

Significance of molecular weight, discussion of methods and their application to high molecular weight stocks, limitation and evaluation of methods, by F. H. Stross, Shell Development Co.

Correlative Methods

Correlative methods for structure of solid saturated hydrocarbons employing a new concept for the relationship between ASTM viscosity slope and chain length, by G. G. Rumberger, Marathon Corp.

For the final afternoon session of the two-day meeting the group will hold its traditional "Town Meeting." Chairman of this event will be H. M. Smith, of the U.S. Bureau of Mines.

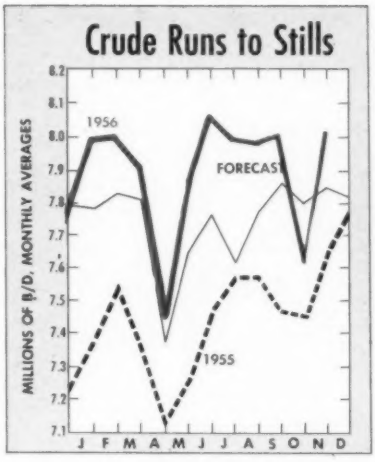
Engineers' Salary Panel At EJC Annual, Jan. 17-18

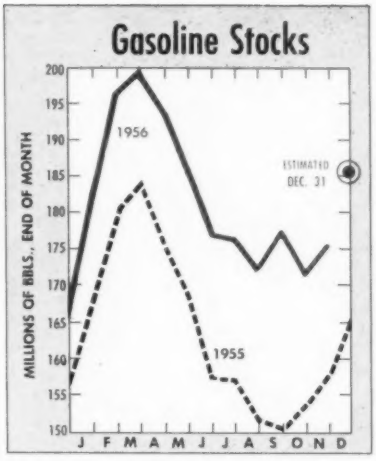
The annual meeting of the Engineers Joint Council will feature a panel discussion on the engineer's salary structure. The event will be held on January 17-18 in New York City's Statler Hotel.

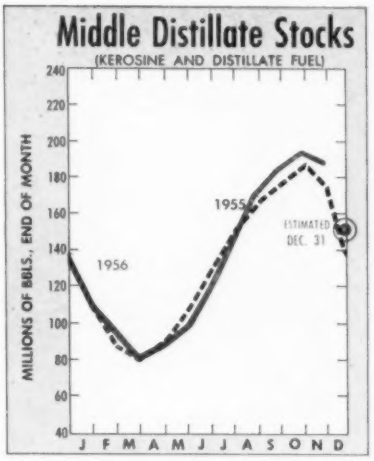
Members of the panel are as follows: Dr. Edward Peck, retired from Esso Research and Engineering Co.; Frank Leamer, Bell Telephone Laboratories; Donald Vrots, California Research Corp. The panel will discuss the latest data on engineers' salaries and the methods of salary administration.

"The Engineer and the American Economy" will be the topic of the luncheon speaker, Prof. John Bell Rae, Case Institute of Technology. Dr. Henry Heald, president of the Ford Foundation, will address the group at a dinner meeting.

Other speakers will be Dr. Werner von Braun and Maj. Gen. J. B. Madaris, of the U.S. Army Ballistic Missile Agency; and W. A. C. Illiff, International Bank for Reconstruction and Development.






Middle Distillate Stocks
(KEROSINE AND DISTILLATE FUEL)
MILLIONS OF BBLS., END OF MONTH
1956
1955
ESTIMATED DEC. 31
J F M A M J J A S O N D

Product Stocks Top 400,000,000 Bbl

OUTLOOK: Higher crude runs than forecast, in anticipation of export demand for distillate and residual fuel oils.

RUNS TO stills in November, 8,026,000 b/d avg., were 4.2% larger than a year ago. This despite the fact that the demand for each of the four major products, with the exception of motor fuel, was less than in November, 1955. Gasoline demand, 3,823,000 b/d avg., was 2.6% higher than a year ago.

Distillate fuel oil demand was about 3.5% less than a year ago, and combined middle distillate demand (kerosine and distillate fuel oil) declined over 5% from Nov., 1955 demand. This was due to the fact that warmer-than-normal temperatures prevailed in November.

Distillate fuel oil stocks of 153,498,000 bbl Nov. 30, were 13,395,000 bbl (9.6%) larger than on Dec. 2, 1955. Only in the Gulf Coast, inland Texas and Northern Louisiana-Arkansas districts, did distillate fuel oil stocks decline from the 1955 levels.

The Gulf Coast is feeling the effects of larger than normal exports, due to the Suez Canal situation. It is too early to predict what effect Suez will have on the distillate inventories in other districts, though demand from abroad is expected to be heavy. However, it is believed that heating oil stocks are adequate to take care of the needs of a normal winter.

Gasoline stocks at Nov. 30, 1956 were 175,401,000 bbl, 17,886,000 bbl (11.3%) over their Dec. 2, 1955 level. Demand from abroad will probably be lightest for this product. While motor fuel is the only one of the major products which showed an increased demand in Nov., 1956 over Nov., 1955, the increase was only 2.6%, whereas the Nov., 1955 demand increased more than 6% over Nov., 1954. It is felt that these stocks are still too high, and will go higher unless the refiner adjusts his yields to take care of the larger distillate and residual demands expected from abroad.

Residual fuel oil demand was also slightly off from a year ago, but strong demand is expected to develop from foreign markets. Stocks were at about their levels of a year ago.

NOVEMBER KEY STATISTICS

(Figures given in terms of millions of b/d monthly averages, except stocks which are in millions of bbl at end of month)

	Nov. 1956	Oct. 1956	Nov. 1955
CRUDE OIL			
U. S. Production	7.124	6.997	7.014
Imports	.845	.999	.823
U. S. Stocks	275.906	283.164	260.707
Runs to Stills	8.026	7.625	7.692
GASOLINE			
Refinery Output	3.822	3.744	3.789
Refinery Demand	3.823	3.939	3.725
Primary Stocks	175.401	172.443	157.871
MIDDLE DISTILLATES			
Refinery Output	2.195	2.136	2.021
Refinery Demand	2.369	1.951	2.505
Primary Stocks	188.093	193.311	175.091
RESIDUALS			
Refinery Output	1.181	1.106	1.214
Imports & Other	.451	.462	.460
Total Supply	1.632	1.568	1.674
Refinery Demand	1.749	1.553	1.773
Primary Stocks	44.389	47.906	44.071

PRODUCT AND CRUDE PRICES

(Products—¢ gal, weighted average prices in principal refinery markets
Crudes—$/bbl, principal fields
Source—Platt's Oilgram Price Service)

	Nov. 1956	Oct. 1956	Nov. 1955
Gasoline (regular)	11.80	11.88	11.81
Distillate Fuel Oil	9.49	9.40	8.93
Kerosine	11.08	11.05	10.35
Residuals	5.51	5.26	4.84
Above 4 Products	9.53	9.48	9.22
Lube Oils	22.86	22.86	20.28
Crude	2.86	2.84	2.83

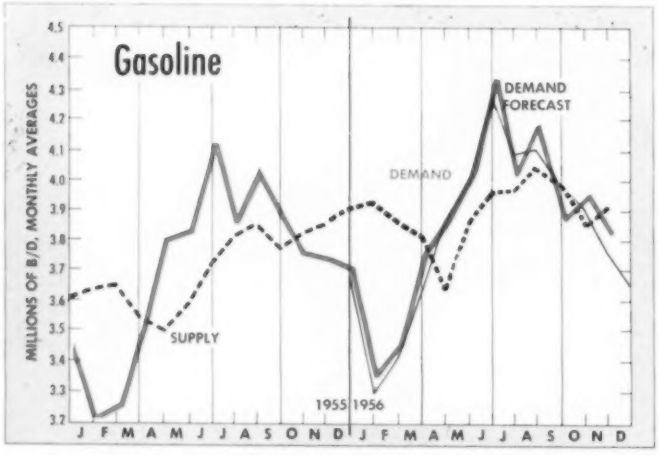
REFINERY YIELDS

% on Crude Runs of Stills

	Nov. 1956	Oct. 1956	Nov. 1955
Gasoline	43.1	44.6	44.2
Kerosine	4.7	4.7	4.4
Distillate	22.7	23.3	21.8
Residuals	14.7	14.5	15.7

SOURCE OF DATA (except prices): Oct. and Nov., API weekly reports; earlier months, Bureau of Mines

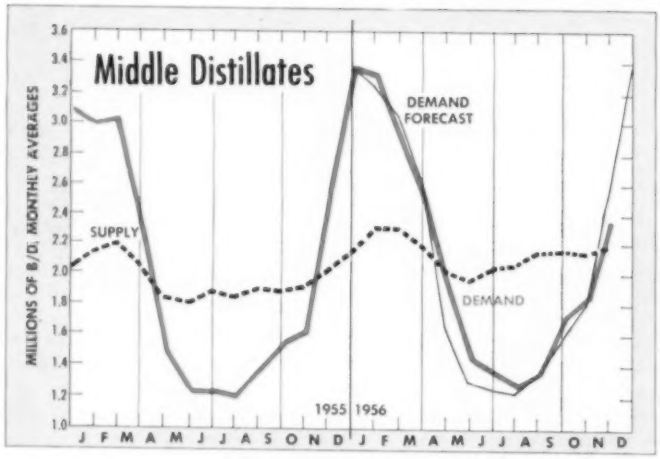
Seasonal Decline in Gasoline Demand



MOTOR FUEL

	From Crude	From Nat. Gas	Total
SUPPLY (Millions of b/d)			
Nov. '56	3.458	.464	3.922
Nov. '55	3.409	.458	3.867
Change	+ .049	+.006	+ .055
% Change	+ 1.4	+ 1.3	+ 1.4
DEMAND (including Exports) (Millions of b/d)			
Nov. '56			3.823
Nov. '55			3.725
Change			+ .093
% Change			+ 2.6
TOTAL SUPPLY (Millions of bbl)			
11 Mos. '56	1,156.452	149.482	1,305.934
11 Mos. '55	1,097.396	142.516	1,239.912
Change	+ 59.056	+ 6.966	+ 66.022
% Change	+ 5.4	+ 4.9	+ 5.3
TOTAL DEMAND (including Exports) (Millions of bbl)			
11 Mos. '56			1,297.804
11 Mos. '55			1,241.989
Change			+ 55.815
% Change			+ 4.5

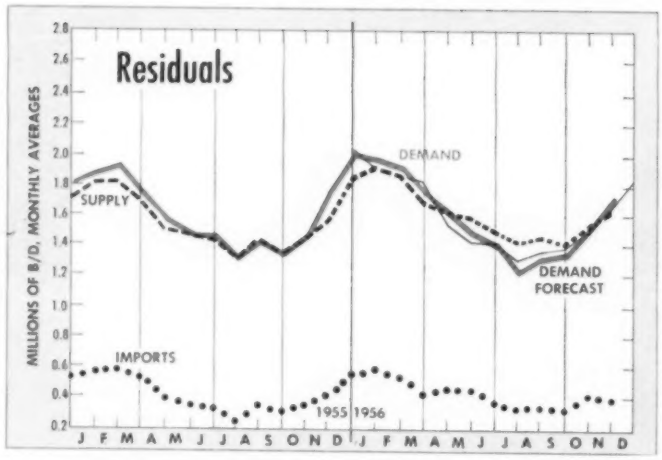
Distillate Shipments Reflect Mild November


Middle Distillates
MILLIONS OF B/D, MONTHLY AVERAGES
DEMAND FORECAST
SUPPLY
DEMAND
1955 1956
J F M A M J J A S O N D J F M A M J J A S O N D

MIDDLE DISTILLATES

	Kerosine	Dist. Fuel Oil	Total
PRODUCTION (Millions of b/d)			
Nov. '56	.376	1.819	2.195
Nov. '55	.341	1.680	2.021
Change	+ .035	+ .139	+ .174
% Change	+ 9.7	+ 8.2	+ 8.6
DEMAND (including Exports) (Millions of b/d)			
Nov. '56	.391	1.978	2.369
Nov. '55	.455	2.050	2.505
Change	— .064	— .072	— .136
% Change	— 14.1	— 3.5	— 5.4
TOTAL PRODUCTION (Millions of bbl)			
11 Mos. '56	111.540	603.831	715.371
11 Mos. '55	106.847	548.454	655.301
Change	+ 4.693	+ 55.377	+ 60.070
% Change	+ 4.4	+ 10.1	+ 9.2
TOTAL DEMAND (including Exports) (Millions of bbl)			
11 Mos. '56	105.187	567.583	672.770
11 Mos. '55	101.490	520.018	621.408
Change	+ 3.697	+ 47.565	+ 51.362
% Change	+ 3.6	+ 9.1	+ 8.3

Little Change in Residual Fuel Oil Supply


Residuals
MILLIONS OF B/D, MONTHLY AVERAGES
DEMAND
SUPPLY
DEMAND FORECAST
IMPORTS
1955 1956
J F M A M J J A S O N D J F M A M J J A S O N D

RESIDUAL FUELS

	Refinery Output	Imports& Other	Total
SUPPLY (Millions of b/d)			
Nov. '56	1.181	.451	1.632
Nov. '55	1.214	.460	1.674
Change	— .033	—.009	— .042
% Change	— 2.7	— 2.0	— 2.5
DEMAND (including Exports) (Millions of b/d)			
Nov. '56			1.749
Nov. '55			1.773
Change			— .024
% Change			— 1.4
TOTAL SUPPLY (Millions of bbl)			
11 Mos. '56	387.479	149.388	536.867
11 Mos. '55	380.452	139.202	519.654
Change	+ 7.027	+ 10.186	+ 17.213
% Change	+ 1.8	+ 7.3	+ 3.3
TOTAL DEMAND (including Exports) (Millions of bbl)			
11 Mos. '56			531.744
11 Mos. '55			527.688
Change			+ 4.056
% Change			+ 0.8

SOURCE OF DATA: Oct. and Nov., API weekly reports; earlier months, Bureau of Mines (1956 figures for 366 days)

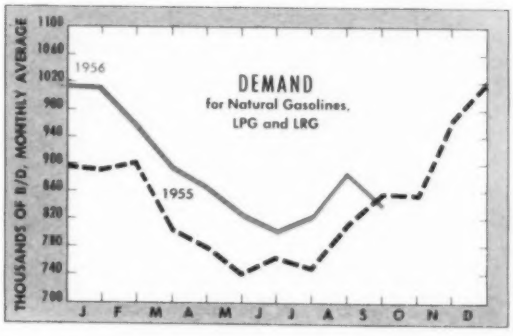
RUNS TO STILLS AND DISTRIBUTION OF PRIMARY STOCKS BY U. S. REFINERY DISTRICTS

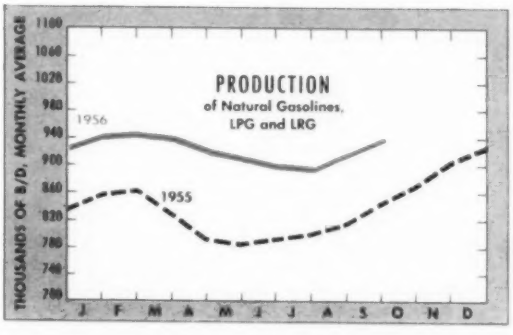
(Primary stocks include those at refineries, at large terminals and in pipelines; all data based on API reports)

District	RUNS TO STILLS (Millions of b/d average for week ending on date shown) Nov. 30 1956	Dec. 2 1955	Change	% Change	GASOLINE STOCKS (Millions of bbl on date shown) Nov. 30 1956	Dec. 2 1955	Change	% Change	RESIDUAL STOCKS (Millions of bbl on date shown) Nov. 30 1956	Dec. 2 1955	Change	% Change
East Coast	1.150	1.091	+ .059	+ 5.4	40.581	36.688	+ 3.893	+10.6	11.396	12.371	— .975	— 7.9
Gulf Coast	2.689	2.621	+ .068	+ 2.6	36.634	29.235	+ 7.399	+25.3	8.173	8.582	— .409	— 4.8
Total Coastal	3.839	3.712	+ .127	+ 3.4	77.215	65.923	+11.292	+17.1	19.569	20.953	— 1.384	— 6.6
Appalachian	.206	.218	— .012	— 5.5	7.318	6.730	+ .588	+ 8.7	.712	1.044	— .332	—31.8
Ind.-Ill.-Ky.	1.497	1.449	+ .048	+ 3.3	33.300	32.363	+ .937	+ 2.9	5.911	4.725	+ 1.186	+25.1
Okla.-Kans.-Mo.	.747	.708	+ .039	+ 5.5	18.329	15.958	+ 2.371	+14.9	1.571	1.629	— .058	— 3.6
Other Inland	.672	.638	+ .034	+ 5.3	17.041	15.279	+ 1.762	+11.5	3.067	2.195	+ .872	+39.7
Total Inland	3.122	3.013	+ .109	+ 3.6	75.988	70.330	+ 5.658	+ 8.0	11.261	9.593	+ 1.668	+17.4
Total East of Calif.	6.961	6.725	+ .236	+ 3.5	153.203	136.253	+16.950	+12.4	30.830	30.546	+ .284	+ 0.9
Calif.	1.153	1.076	+ .077	+ 7.2	22.198	21.282	+ .916	+ 4.3	13.559	13.610	— .051	— 0.4
Total U. S.	8.114	7.801	+ .313	+ 4.0	175.401	157.535	+17.866	+11.3	44.389	44.156	+ .233	+ 0.5

District	DISTILLATE FUEL OIL STOCKS (Millions of bbl on date shown) Nov. 30 1956	Dec. 2 1955	Change	% Change	KEROSINE STOCKS (Millions of bbl on date shown) Nov. 30 1956	Dec. 2 1955	Change	% Change	TOTAL MIDDLE DISTILLATE STOCKS (Millions of bbl on date shown) Nov. 30 1956	Dec. 2 1955	Change	% Change
East Coast	59.387	52.469	+ 6.918	+13.2	13.474	13.984	— .510	— 3.6	72.861	66.453	+ 6.408	+ 9.6
Gulf Coast	22.196	23.417	— 1.221	— 5.2	6.149	6.081	+ .068	+ 1.1	28.345	29.498	— 1.153	— 3.9
Total Coastal	81.583	75.886	+ 5.697	+ 7.5	19.623	20.065	— .442	— 2.0	101.200	95.951	+ 5.255	+ 5.5
Appalachian	4.638	3.932	+ .706	+18.0	1.307	1.105	+ .202	+18.3	5.945	5.037	+ .908	+18.0
Ind.-Ill.-Ky.	28.221	26.167	+ 2.054	+ 7.8	8.460	8.116	+ .344	+ 4.2	36.681	34.283	+ 2.398	+ 7.0
Okla.-Kans.-Mo.	18.271	14,206	+ 4.065	+28.6	2.759	1.973	+ .786	+39.8	21.030	16.179	+ 4.851	+30.0
Other Inland	7.390	8.018	— .628	— 7.8	2.087	1.554	+ .533	+34.3	9.477	9.572	— .095	— 1.0
Total Inland	58.520	52.323	+ 6.197	+11.8	14.613	12.748	+ 1.865	+14.6	73.133	65.071	+ 8.062	+12.4
Total East of Calif.	140.103	128.209	+11.894	+ 9.3	34.236	32.813	+ 1.423	+ 4.3	174.339	161.022	+13.317	+ 8.3
Calif.	13.395	11.894	+ 1.501	+12.6	.359	.408	— .049	—12.0	13.754	12.302	+ 1.452	+11.8
Total U. S.	153.498	140.103	+13.395	+ 9.6	34.595	33.221	+ 1.374	+ 4.1	188.093	173.324	+14.769	+ 8.5

Natural Gas and Refinery Gas Liquids





SUPPLY AND DEMAND STATISTICS

(Bureau of Mines Data)

CURRENT PRODUCTION (1000 b/d monthly average)	Sept. 1956	Aug. 1956	Sept. 1955
At Natural Gasoline & Cycling Plants			
Liquified Petroleum Gas	409	391	357
Natural Gasoline and Isopentane	303	308	287
Condensate	7	24	21
Finished Gasoline, Naphtha & other	72	55	61
Total Natural Gasoline and Cycling Plant Production	791	778	726
Liquefied Refinery Gases	143	139	122
Total Marketable Gas Liquids	934	917	848
Lease Condensate	113	111	108
Total Natural Gas Liquids	1,047	1,028	956
CURRENT DEMAND (1000 b/d monthly average)			
LPG and LRG	470	500	479
Natural Gasoline, Isopentane & Other	379	391	380
Total Marketable Gas Liquids	849	891	859

CUMULATIVE PRODUCTION (1000 bbl)	Sept. 1956	Sept. 1955
LPG and LRG	148,772	125,842
Natural Gasoline, Isopentane and Other	103,557	98,455
Total Marketable Gas Liquids	252,329	224,297
CUMULATIVE DEMAND (1000 bbl)		
LPG and LRG	142,400	121,622
Natural Gasoline, Isopentane and Other	96,298	99,180
Total Marketable Gas Liquids	238,698	220,802

STOCKS (1000 bbl, end of month)	Sept. 1956	Aug. 1956	Sept. 1955
LPG and LRG	17,130	14,679	11 978
Natural Gasoline, Isopentane & Other	5,223	5,134	4.401
Total Stocks	22,353	19,813	16.379

Unique combination of fine engineering and economy!

...the new FOXBORO M/44 INDICATING PRESSURE TRANSMITTER

- Easier to Read . . . large indicator scale, visible at 20 ft.
- Easier to Calibrate . . . simple adjustments "on location"
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Any way you look at it, the new Foxboro M/44 Pneumatic Pressure Transmitter gives you an unmatched combination of fine engineering and economy. First; because it *is* an engineered instrument. There are no attachments or "makeshifts". Second; because it utilizes standard Foxboro parts throughout—parts which have been performance-proved in thousands of successful installations of other Foxboro Instruments. And this means not only top performance, but easier servicing and stocking as well. Third; calibration is simple, right in the field, because the M/44 is "convenience-designed" by men with years of experience in every phase of instrument design and application.

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Petroleum Processing

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Do you need detailed information on a specific subject? Check through this easy-to-use index of literature and data being offered in this issue's advertisements.

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CLEANING COMPOUNDS, booklet; Oakite Products, Inc. See adv't. p. 144.

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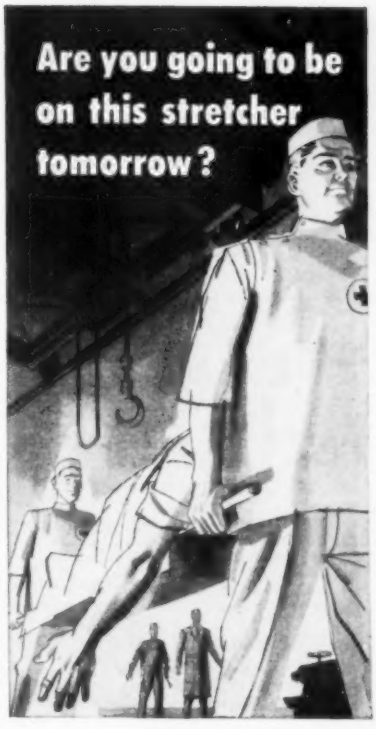

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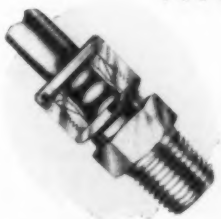

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(To obtain more data on advertised products see page 132)

Petroleum Processing

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- **'Instrument Charts' Track Costs**—use of control charts by British American Oil Co. tells when operating costs are out of limits. 8 pages—$0.25: Reprint **R36**
- **Drafting Production Manual**—for better and faster drafting, with do-it-yourself slide rule for flange and fitting drafting data. 24 pages—$1.25: Reprint **R31**
- **Hydrogen Processing in the Refinery**—Special Report on what it is, how it works, who uses it, processes and catalysts. 24 pages—$0.75: Reprint **R30**
- **How Computers Can Help You**—valuable training and information booklet. 12 pages—$0.25: Reprint **R23**
- **Optimum Bubble-Cap Tray Design**—for process design of bubble-cap trays. 56 pages—$1.50: Reprint **R15**
- **Chemical Treating of Petroleum Fuels**—to remove and/or convert impurities. 24 pages—$0.75: Reprint **R12**
- **Vaporization Equilibrium Constant and Activity Coefficient Charts.** 48 pages—$1.50: Reprint **R1**
- **Clip•n•File Sheets**—$0.20 each, any 6 for $1.00. Process Data Sheets (PDS's) are 3-page fold-outs. Engineering Data Sheets (EDS's) are 2 pages on special, heavy paper for repeated handling and reference:

PDS 12, **Process Reference List—1954**	Reprint **R32**
PDS 13, **Thermofor Catalytic Reforming**	Reprint **R34**
PDS 14, **Process Reference List—1956**	Reprint **R37**
EDS 11, **Measuring Viscosity**	Reprint **R33**
EDS 12, **Metals Glossary**	Reprint **R35**
EDS 13, **Plastics Glossary**	Reprint **R38**

(For preceding PDS and EDS sheets, see complete listing on page 137 of this issue)

Prices for quantity orders furnished on request

Iso-Kel Isomerization of Pentane-Hexane Fractions

	Kuwait		Mid-Continent		Nat. Gasoline	
	Feed	Product	Feed	Product	Feed	Product
Total C_5-C_6 Fraction	100.0	97.3	100.0	96.7	100.0	99.2
Vol%, feed basis	100.0	97.3	100.0	96.7	100.0	99.2
Octane, CFRR, clear	63.7	77.7	62.1	77.0	72.3	83.3
Octane, CFRR + 3cc TEL	88.3	96.2	87.3	95.8	93.9	99.8
Pentane Fraction						
Vol% of total C_5-C_6	45.0	45.0	34.5	34.5	58.5	58.5
Octane, CFRR, clear	74.4	91.0	72.9	91.0	79.2	91.0
Octane, CFRR + 3cc TEL	95.8	104.9	94.9	104.9	98.4	104.9
Hexane Fraction						
Vol% of total C_5-C_6	55.0	52.3	65.5	62.2	41.5	40.7
Octane, CFRR, clear	54.9	66.3	56.4	69.2	62.6	72.2
Octane, CFRR + 3cc TEL	82.2	88.7	83.3	90.7	87.5	92.4

Octane numbers above 100 by formula: ON = 128 − (2800/PN)

Higher octanes from light naphthas

The "Iso-Kel" Isomerization Process

A new isomerization process, Iso-Kel, to help refiners upgrade the octanes of combined pentane and hexane fractions has been announced by the M. W. Kellogg Co.

The new process is said to differ from other recently announced isomerization processes by using a non-platinum (though noble metal) catalyst.[1,2,3]

Iso-Kel produces two separate products from a mixed pentane-hexane stream: 1) an isopentane stream of 104.9 research octane (with 3 cc TEL), and 2) an isohexane stream of 89-92 research octane (with 3 cc TEL), depending on the feedstock.

Typical isomer yields from Iso-Kel processing of pentane-hexane fractions are shown in the table above. The isopentane stream can be allocated for the super premium gasoline and the isohexane stream for the house brand.

When charging light naphtha, the combined streams have an overall yield of 97%, and an octane number of 96 research with 3 cc TEL. When charging natural gasoline, overall yield is 99 vol%, with a research octane of about 99.8 with 3 cc TEL.

The process and catalyst were developed in Kellogg's research laboratories. Only one reactor, which operates in the presence of hydrogen, is needed for the vapor-phase process. There are no corrosive elements in the system, and operating conditions are less severe than those for reforming heavy naphtha.

A payout time of about 19 months is anticipated in the case of a 3100 b/d Iso-Kel unit in a 50,000 b/d refinery. **M. W. Kellogg Co.,** 711 Third Ave., New York 17, N. Y.

Circle No. **19** *on Reply Card*

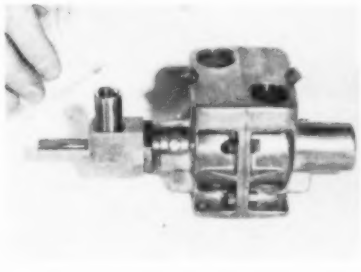
Gear Motor

. . . **mounts on valve stem** and turns a manual valve into a motor-driven valve.

The Jordan Shaftrol provides remote and automatic control for valves and pumps, feeders and variable speed drives. It can be mounted in place of standard handwheels, knobs or cranks —in either horizontal or vertical positions.

A wide choice of output speeds and torques is provided by changing the ratio of reduction gears. Speeds from ½ to several hundred rpm is possible with the standard units. Torques can vary from a few inch ounces to several hundred inch-pounds. Single phase units use an instantly reversible, permanently split capacitor motor having high starting torque with low inruch current. Three-phase Shaftrols are available in larger sizes. **The Jordan Co.,** Milwaukee, Wis.

Circle No. **21** *on Reply Card*



Fluid Teflon Seal

. . . **for corrosion-resistant** pumps eliminates the passage of gases or fluids into or out of the pump.

Available for their line of rotary, positive displacement pumps, this fluid seal on the ECO line pumps not only seals but also lubricates the shaft. The seal is arranged as an annular ring around the shaft, in which two Teflon seal-ring retainers holds the mass of fluid Teflon. A screw piston provides positive pressure on the seal.

The seal has been tested for long periods on chemical pumps handling corrosive and difficult-to-handle liquids such as carbon tetrachloride, hot dilute sulfuric acid and hot lubricating oils. Operating conditions ranged from heads of 100 psi and vacuums of 28 in. **ECO Engineering Co.,** 12 New York Ave., Newark 1, N. J.

Circle No. **20** *on Reply Card*

Silicate Coating

. . . **resists corrosion** and can be spray-coated like paint. It drys to the touch a few minutes after application.

Profilm, a silicate modified coating can be applied to almost any surface including metal, masonry, wood, asbes-

Another Chance

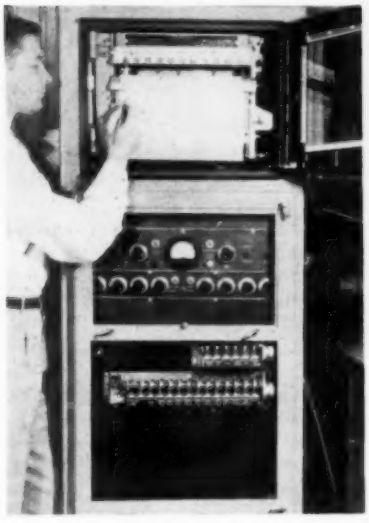
to read about hot new developments in equipment. The top items of 1956, measured by reader interest, are reprinted in this issue on pp. 50-51.

These are the items that hit PETROLEUM PROCESSING's readers with the greatest impact over the year. Don't miss "Tops in What's New."

tos, etc. Because of its almost inert composition, it provides a low porosity film that resists a wide variety of chemicals.

These new coating materials are fire retardant and will not support combustion. They are non-toxic and will not form scum on exposure to air. They come in both baking and air-dry grades, and are available in colors, black, white, clear and metallic finish. **Allied Porcenell, Inc.,** 851 S. Market St., Waukegan, Ill.

Circle No. **22** *on Reply Card*



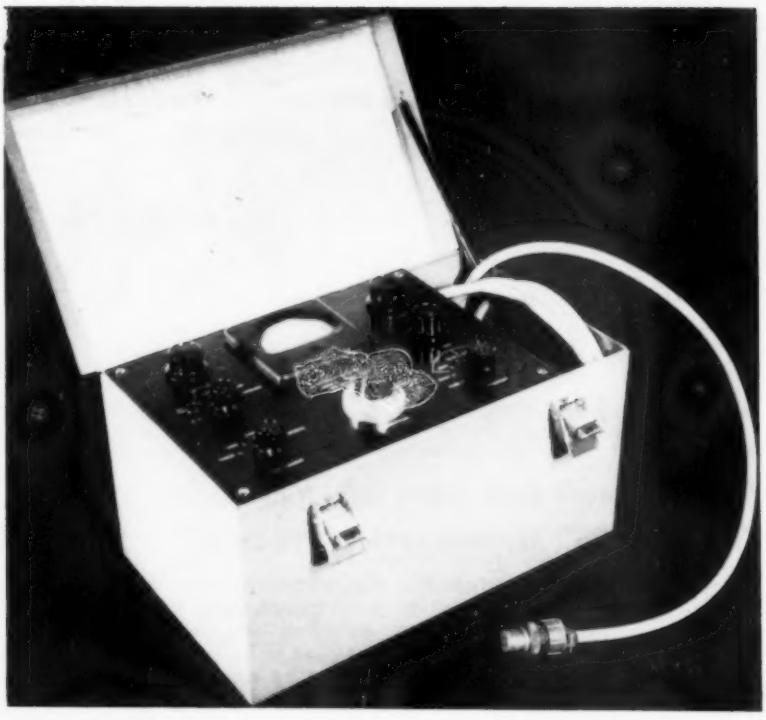
Process Control Chromatograph

. . . **continuously samples** any gas process stream and records, by percentage, each chemical component present. This information can be fed into a simple control system that can record and automatically correct any deviations.

The Process Gas Chromatograph automatically passes a sample from the process stream through a chromatographic column of absorbent material, which breaks it up into component parts. A stream of helium washes the fractions out of the column, in successive order, and a thermal conductivity cell determines the amount and type of compounds present. The information is presented as a "bar graph" on the recorder.

Precisely timed valves can be set up to analyze up to eight components of a single stream, or from two to seven different plant streams of similar composition. Once set, the operation of the instrument is completely automatic. **Beckman Instruments, Inc.,** 2500 Fullerton Road, Fullerton, Calif.

Circle No. **23** *on Reply Card*



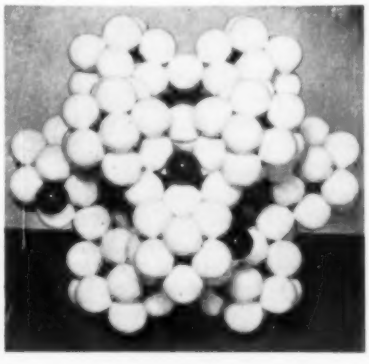
Electrical Probe
Detects Corrosion in Microinches

The Corrosometer measures the progress of corrosion by measuring the loss of a metal probe directly in microinches of penetration into the metal. The probe can either be immersed in a corrosive solution for instantaneous reading, or mounted permanently in the suspected environment for continuous readings.

Measuring corrosion by this instrument has several advantages over traditional methods. Rapid and direct readings can be made within 30 sec; no shutdown is needed to retrieve metal specimens; measurements can be made in inaccessible spots by use of several hundred feet of cable from the probe to the meter; and accumulation of corrosion products do not effect measurements.

Three types of Corrosometers are available. Model C is a portable unit for field use or in the laboratory. Model K is designed primarily for laboratory use or wherever AC power is available. Model R is an automatic recording instrument. **Crest Instrument Co.,** 11808 S. Bloomfield, Santa Fe Springs, Calif.

Circle No. **24** *on Reply Card*



New Dessicant

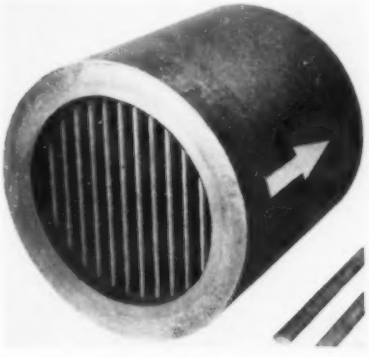
. . . has 19 times the water adsorption capacity of the best of the silica-type adsorbents, and performs well at temperatures as high as 112°F.

Developed as a new class of dessicants, "Molecular Sieves" have extremely small pores in their crystalline structure that exclude both refrigerant and oil molecules. This permits the entire surface of these crystalline alumino-silicates to adsorb selectively only water molecules. The material will release this water of hy-

dration when activated by heat, with little or no change in cyrstal structure.

Molecular Sieves have an absorption capacity of 19 wt-% when used with a concentration of 10 ppm of residual water in Refrigerant-12, at a temperature of 140°F. It can be obtained in the form of hard spherical pellets for use in refrigeration systems, existing adsorption units, or for effective drying in units located in small hot motor compartments. **Linde Air Products Co.,** 30 East 42nd St., New York 17, N. Y.

Circle No. **25** *on Reply Card*



Entrainment Separator

. . . **of impervious graphite** resists corrosion and can be inserted in a pipe line for removing liquid particles from air, steam, or other gases.

Within the unit, rods of Karbate (impervious graphite), which are streamlined in cross-section, are staggered in rows. Minimum clearance is ¼-in. to prevent clogging, but a beam of light will not pass through. Moisture particles impinge on the separator rods and the gas flows through.

Separation efficiency can be maintained over a wide operating range. At one atmosphere the separator will remove 100% of 11-micron size particles from steam and 99.8% from air. Efficiency in steam (at 4 in. Hg Abs) decreases to 91% as the particle sizes are reduced to 3.6 microns. The unit can be operated at temperatures ranging from 340° F to —40° F, and at pressures from full vacuum to 65 psig. The graphite material is chemically inert to mineral acids, organic solids, salt solutions and other corrosives.

The separator is available from stock in four sizes: 6, 8, 12 and 16 in. internal cylinder diameter. Each is 22 in. long and designed for installation between the faces of 150-lb ASA flanges. **National Carbon Co.,** 30 East 42nd St., New York 17, N. Y.

Circle No. **26** *on Reply Card*

(Continued on p. 140)

You Can Add These

PETROLEUM PROCESSING Reprints

To Your Files

(Use the Reader Service Cards on pages 133-134 to order)

PETROLEUM PROCESSING Special Reports:

Hydrogen Processing—An Appraisal of Its Use in the Refinery, by Robert L. Davidson; what it is, how it works, what it does, who's using or planning to use it, processes and catalysts. 24 pages, December 1956 Reprint **R30** $0.75

Evaporation Losses—And their Control in Storage, by Willis A. Bussard; what evaporation is, storage conditions that affect it, equipment and other methods to reduce losses, estimating losses, selecting the right tank. 24 pages, July 1956 Reprint **R20** $0.75

Heat Exchangers—And Their Use in Processing Petroleum, by Daniel A. Donahue; what they are, how they're made, their design, use, installation, operation, maintenance and cost. 32 pages, March 1956 Reprint **R8** $1.00

Catalytic Reforming—And Aromatics Recovery in the Refinery, by Virgil B. Guthrie and Robert L. Davidson; what it is and does, who's using or planning to use it, processes for reforming and aromatics recovery. 48 pages, August 1955 Reprint **R3** $0.75

PETROLEUM PROCESSING Data Sheets:

Process Data Sheets are process descriptions with flow diagrams, process conditions, economics, etc. 3-page fold-out sheets—$0.20 each, or any 6 PDS or EDS sheets for $1.00:

PDS 1, **Ethylene Oxide** **R4**
PDS 2, **Butadiene · Butenes** **R5**
PDS 3, **L'Azote Ammonia** **R6**
PDS 4, **Ethylene—Kellogg** **R9**
PDS 5, **Fluid Coking** **R10**
PDS 6, **Chemico Urea** **R16**
PDS 7, **Ethylene—Stone & Webster** **R18**
PDS 8, **TCP—Socony Mobil** **R21**
PDS 9, **Process References—1947** **R24**
PDS 10, **Ammonia—Kellogg** **R26**
PDS 11, **Pentafining** **R28**
PDS 12, **Process References—1954** **R32**
PDS 13, **Thermofor Catalytic Reforming** **R34**
PDS 14, **Process References—1956** **R37**

Engineering Data Sheets contain basic data and information on a variety of subjects. 2 pages—$0.20 each, or any 6 EDS or PDS sheets for $1.00.

EDS 1, **Pressure Fundamentals** **R7**
EDS 2, **Temperature Fundamentals** **R11**
EDS 3, **Fluid Flow Fundamentals** **R13**
EDS 4, **Flow Restrictions in Pipe** **R14**
EDS 5, **Tank Capacities—I** **R17**
EDS 6, **Heat—and Its Transfer** **R19**
EDS 7, **Vapor Pressure** **R22**
EDS 8, **Distillation Fundamentals** **R25**
EDS 9, **Heat Fuel Comparison** **R27**
EDS 10, **Tank Capacities—II** **R29**
EDS 11, **Measuring Viscosity** **R33**
EDS 12, **Metals Glossary** **R35**
EDS 13, **Plastics Glossary—A-L** **R38**

ISO-

ISOMERIZATION

- Isomerizes Pentane and Hexane Fractions
- New, Precious Metal Catalyst (non-platinum)
- Isomer Yields of 97% and Higher
- Flexibility of Feedstocks
- No Corrosive Elements in System
- Only One Reactor Needed
- Minimum Makeup Hydrogen Required

ISOMERIZATION OF PENTANE-HEXANE FRACTION FROM COMMERCIAL STOCKS

	KUWAIT		MID-CONTINENT		NAT. GASOLINE	
	Feed	Product	Feed	Product	Feed	Product
TOTAL C_5-C_6						
Vol. %	100.0	97.3	100.0	96.7	100.0	99.2
Octane CFRR-Clear	63.7	77.7	62.1	77.0	72.3	83.3
+3 cc TEL	88.3	96.2	87.3	95.8	93.9	99.8
PENTANE FRACTION						
Vol. %	45.0	45.0	34.5	34.5	58.5	58.5
Octane CFRR-Clear	74.4	91.0	72.9	91.0	79.2	91.0
+3 cc TEL	95.8	104.9	94.9	104.9	98.4	104.9
HEXANE FRACTION						
Vol. %	55.0	52.3	65.5	62.2	41.5	40.7
Octane CFRR-Clear	54.9	66.3	56.4	69.2	62.6	72.2
+3 cc TEL	82.2	88.7	83.3	90.7	87.5	92.4

(To obtain more data on advertised products see page 132)

KEL

by M.W. KELLOGG

ISO-KEL is a new process developed by The M. W. Kellogg Company for isomerizing light naphthas. Designed to help refiners increase their high octane pool, ISO-KEL can upgrade combined streams of pentane and hexane fractions as well as natural gasoline.

One desirable application of ISO-KEL produces two separate products: (1) an isopentane stream of 104.9 CFRR+3 cc TEL, and (2) an isohexane stream of 89 to 92 CFRR+3 cc TEL, depending on the feedstock. When charging light naphtha, the combined streams have an over-all yield of 97 vol. % and an octane number of about 96 CFRR+3 cc TEL. When feeding natural gasoline, over-all yield is 99 vol. % and octane number about 99.8 CFRR+3 cc TEL.

The advantages of this new ISO-KEL process rest on a new, precious metal catalyst (not platinum) developed by M. W. Kellogg's research laboratories. This vapor-phase process requires only one reactor—which operates in the presence of hydrogen. Operating conditions are less severe than those for reforming heavy naphtha.

Economic soundness of the ISO-KEL process is illustrated in the case of a 50,000 BPD refinery, where a 3,100 BPD ISO-KEL unit would have a payout of about 19 months. Write for further economic and technical data.

Refinery Process Division

THE M. W. KELLOGG COMPANY

711 Third Avenue, New York 17, N. Y.

A SUBSIDIARY OF PULLMAN INCORPORATED

The Canadian Kellogg Company Limited, Toronto
Kellogg International Corporation, London
Societe Kellogg, Paris
Kellogg Pan American Corporation, New York
Companhia Kellogg Brasileira, Rio de Janeiro
Compania Kellogg de Venezuela, Caracas

Refinery Process Division
THE M. W. KELLOGG COMPANY
711 Third Avenue, New York 17, N. Y.
Send further information on ISO-KEL *Isomerization*

Name_____

_____ (Position)

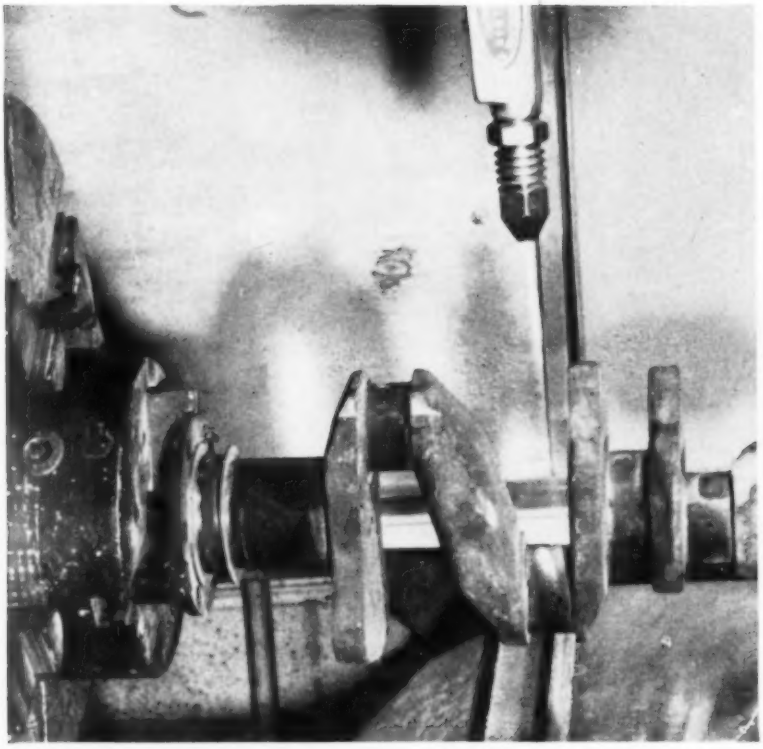
Company_____

Address_____

_____

P.P. 1/57

 (To obtain more data on advertised products see page 132)



Anti-Friction Metal Powder

Reclaims Worn Crankshafts

A new metal powder of high chromium-nickel content, containing chromium borides, can be used for rebuilding engine and compressor crankshafts by the metallizing process. The powdered material is sprayed on the crankshafts after proper preparation of base metal.

Designated as Colmony C-250, the material features an unusually low coefficient of friction, controlled surface porosity and good oil retention properties. Each of these characteristic will contribute to improved wear resistance and service life.

Results on a reclaimed crankshaft of a truck were good. The main and connecting rod journals were metallized with Colmony C-250 and wet ground to finish size. Pulling a payload of 25 tons over 100,000 miles, the truck's crankshaft and bearings had very slight wear when inspected. During this time the oil pressure remained unchanged. **Wall Colmony Corp.,** 19345 John R St., Detroit 3.

Circle No. **27** *on Reply Card*

Moisture Monitor

. . . **measures water content** down to 1 ppm in gaseous mixtures. It permits precise meter readings over a full-scale range of 0 to 1000 ppm, with the output of the analyzer available for telemetering to remote indicators.

Based on a principle developed by E. I. du Pont de Nemours & Co., Inc., the instrument contains an electrolysis cell that continually absorbs and electrolyzes all water in a sample stream. The electrolysis current is measured with a multi-range meter and indicates the water content.

The Moisture Monitor operates on 50/60 cycle, 105-125 volts AC. At temperatures up to 100°C and pressures from 5 to 100 psig, the sample flow is controlled at a flow rate of about 100 cc/min. The unit measures 7½ x 6 x 10 in. and weighs 15 lb. **Consolidated Electrodynamics Corp.,** 300 N. Sierra Madre Villa, Pasadena, Calif.

Circle No. **28** *on Reply Card*

Ultrasonic Cleaning

. . . **of instrument components,** electronic parts and other small parts does not harm delicate equipment.

Cleaning is accomplished by ultrasonic activation of the solvent, which literally blasts away soil from the surfaces. But the process is so gentle that it will not harm the most delicate component. The unusual cleaning action reaches all surfaces that are accessible to the fluid, even blind holes and parts with almost inaccessible geometric configurations.

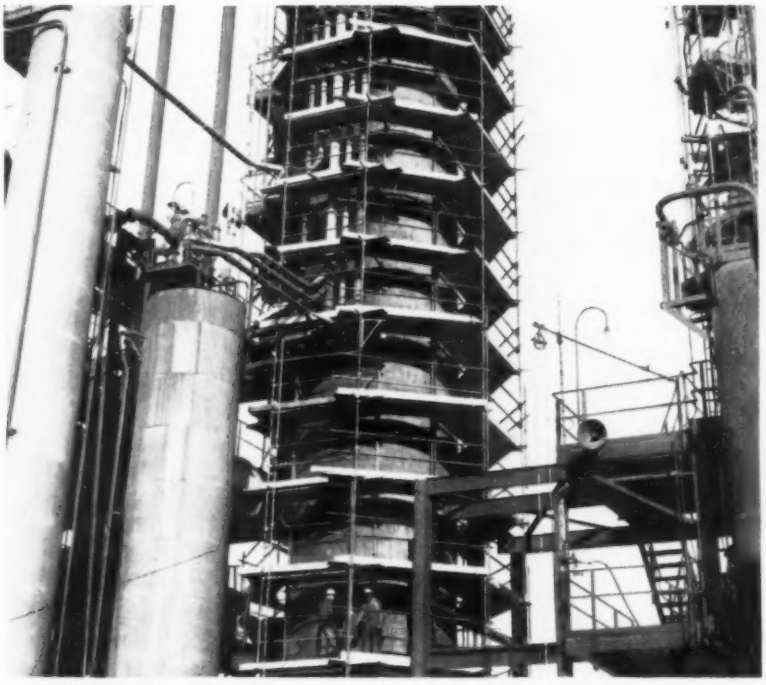
The new instrument, the AP-10-B, is a small and compact 36-40 kc/sec power generator and a cylindrical cleaning tank. The transducers are hermetically sealed into the base. The RF power output of the generator is 50 watts average, with 200 watts peaks on pulses. Tanks are available in 1-pint, 1-quart, or 2-gallon capacity. The effective maximum cleaning area is 18 sq. in. **Branson Ultrasonic Corp.,** 37 Brown House Road, Stamford, Conn.

Circle No. **29** *on Reply Card*

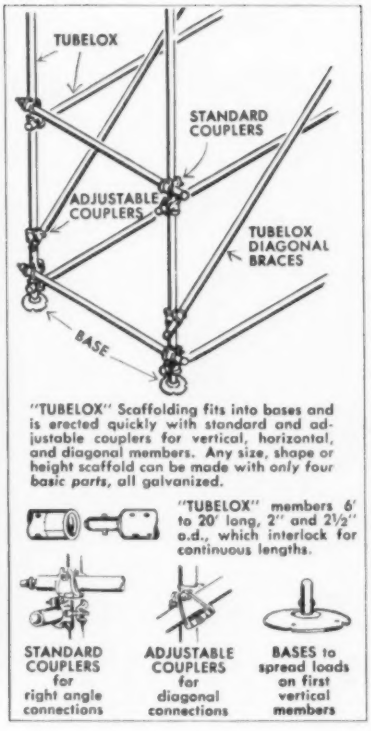
Corrosion Inhibitor

. . . **protects petroleum products** stored in tanks, or shipped in pipe lines and tankers. Added directly to the finished product, it forms a tough monomolecular film on all metal surfaces and prevents contact between the metal surface and corrosive elements in the stored liquid.

Nalco 160-T is an organic surface-



"TUBELOX" SCAFFOLDING assembles quickly for work on alkylation tower.


TUBELOX
STANDARD COUPLERS
ADJUSTABLE COUPLERS
TUBELOX DIAGONAL BRACES
BASE
"TUBELOX" Scaffolding fits into bases and is erected quickly with standard and adjustable couplers for vertical, horizontal, and diagonal members. Any size, shape or height scaffold can be made with only four basic parts, all galvanized.
"TUBELOX" members 6' to 20' long, 2" and 2½" o.d., which interlock for continuous lengths.
STANDARD COUPLERS for right angle connections
ADJUSTABLE COUPLERS for diagonal connections
BASES to spread loads on first vertical members

Saving Turn-Around Time

How one large refinery does it with "TubeLox" Scaffolding

SAVING turn-around time for refinery maintenance and repair duty is an all-important factor. Many hours can be saved if scaffolding and work platforms are provided that can be erected, dismantled and moved with the utmost speed, efficiency and safety.

A large midwestern oil company uses "TubeLox"® Steel Scaffolding because it performs as required. It makes no difference what the turn-around jobs are—cracking, cooling or crude distillation towers; pressure vessels; heat exchangers; tanks, valves or piping—"TubeLox" Scaffolding works perfectly for all.

This versatile, all-purpose scaffolding, galvanized throughout to resist corrosion, is unlimited in its ability to conform to almost any shape, size or height encountered. There are virtually no obstructions which can not be overcome with "TubeLox" Scaffolding . . . even inside of tanks.

Towers and associated piping can be scaffolded with "TubeLox" Scaffolding to provide working platforms at any desired levels. It is fireproof and requires only a minimum amount of wood for staging. The strong, slender members offer little wind resistance and can be combined with "TubeLox" Aluminum End Frames, with built-in ladders, for extra light-weight, easily-handled rolling or stationary scaffolds of medium height.

Another important consideration given to "TubeLox" Scaffolding by this refinery is the fact that all components are 100% recoverable after each use and provide many years of practical, economical service.

"Trouble Saver"® Sectional Steel Scaffolding with standard frames varying from 3′ high x 5′ wide to 6′6″ x 5′, together with pivoted, diagonal braces, are often used for intermediate rolling or stationary platforms in refinery maintenance. "Gold Medal"® Midget and Junior Safety Swinging Scaffolds suspended by steel cables help in speeding the completion of light-duty repairs. The light-weight, ease-of-handling qualities of PS aluminum scaffolds save time and labor on many isolated turn-around jobs.

It would pay you to get the facts on how "TubeLox" and other PS Co. Scaffolding can help you save turn-around time. PS Co. offers complete nation-wide engineering service available locally. See the Yellow Pages in your telephone directory for the nearest Patent Scaffolding Co. office or representative that *sells* or *rents*" Tube-Lox" or "Gold Medal" Scaffolding.

For complete description and installation details . . . write for Bulletins PTS-18 and PTS-19.

FOR GREATER SAFETY...EFFICIENCY...ECONOMY

GOLD MEDAL LADDERS SCAFFOLDING

THE PATENT SCAFFOLDING CO., Inc.

38-21 12th Street Dept. PP Long Island City 1, N. Y.
***West Coast:* 6931 Stanford Ave., Los Angeles 1, Calif.**
Branches in all principal cities
***In Canada:* 355 Dufferin St., Toronto**

(To obtain more data on advertised products see page 132)

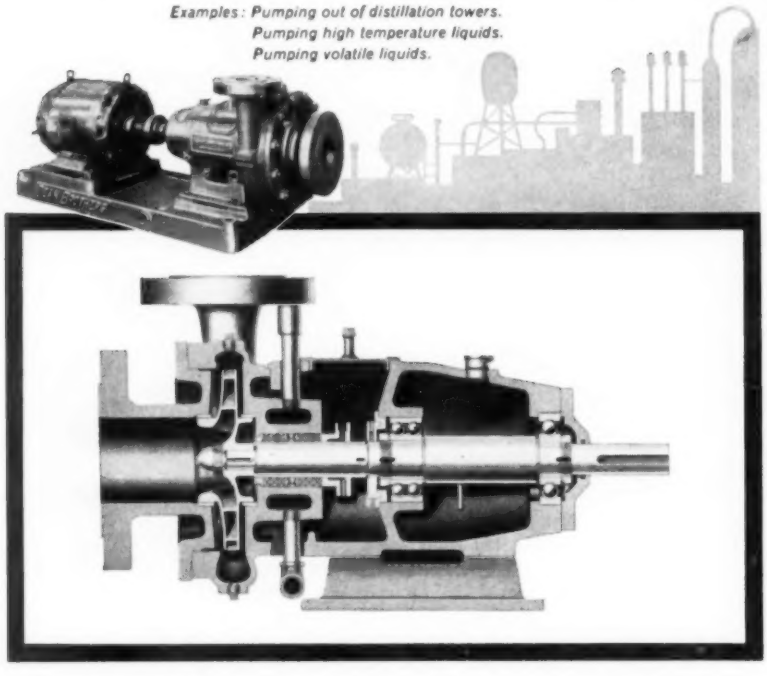
HOW! PUMP USERS—

SOLVE YOUR NPSH* TROUBLES WITH DEAN BROTHERS STANDARD CENTRIFUGAL PUMPS

These standard, horizontal, centrifugal pumps are designed to operate with low **Net Positive Suction Heads.* This keeps equipment and operating costs down in process industries . . .

- where the pump suction is under low absolute pressure,
- where liquid pumped is close to its vapor pressure due to temperature.

Examples: Pumping out of distillation towers.
Pumping high temperature liquids.
Pumping volatile liquids.



The low *NPSH* requirements of Dean Brothers standard centrifugal pumps result from the design of the impeller for low inlet losses—without danger of cavitation and the resultant loss of head and capacity.

Dean Brothers offers a series of charts showing the relationship between pump rotative speed, pump capacity and NPSH. Process designers find them valuable in sizing and locating vessels and pumps on flow sheets as well as for the trouble-free application of pumps. They're **free.** Write for Curve No. S-1 A.

DEAN BROTHERS PUMPS INC.
EST. 1869
323 West 10th St., Indianapolis 7, Ind.

active chemical that is added in dosages of 5 to 50 ppm to a stored product. Once added, no agitation is necessary and protection continues until the tank is emptied. Even then, some residual protection remains, although the film may be destroyed by Butterworthing (cold-steam cleaning) or straight salt water ballast. **National Aluminate Corp.,** 6258 West 66th Place, Chicago 38, Ill.

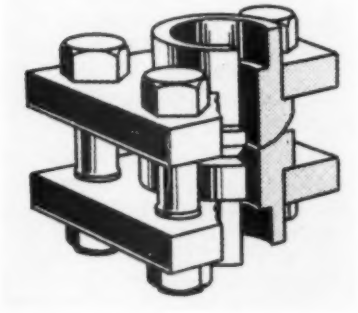
Circle No. **30** *on Reply Card*

Steam Trap

. . . operates from line pressure rather than by float buoyancy. Valves and seats of the trap are of stainless steel and need not to be changed for any pressure. A separate discharge is provided for condensate and air. Dual inlets and outlets permit universal installation in almost all existing lines.

Of special advantage is the attachment of all internal mechanism to an easily removed cover plate, allowing easy inspection and maintenance. The unit is available for ¾ and 1-in. lines requiring discharge capacities up to 25 psig. **W. H. Nicholson & Co.,** 12 Oregon St., Wilkes-Barre, Penn.

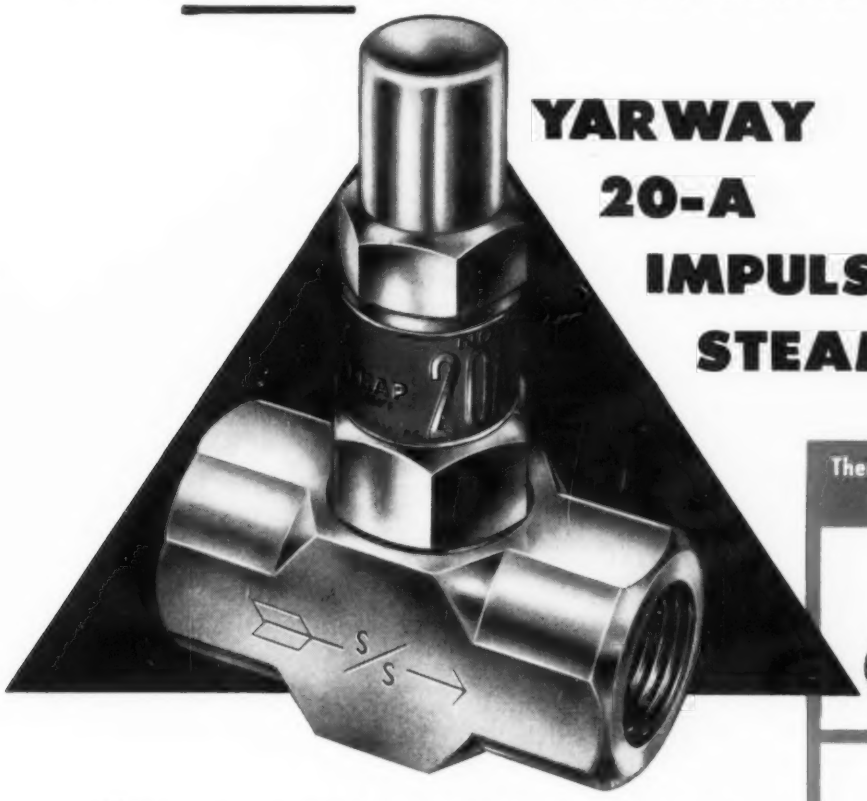
Circle No. **31** *on Reply Card*



Flange Union

. . . for high pressures and socket weld connections will withstand up to 3,000 psi for schedule 80 pipe. Special

THE RIGHT STEAM TRAP FOR LIGHT CONDENSATE LOADS



YARWAY 20-A IMPULSE STEAM TRAP

● Successful companion to the standard Series 60 YARWAY Impulse Steam Trap, the ½" No. 20-A is right and recommended for *light load* applications in:

REFINERIES, CHEMICAL AND PROCESSING PLANTS on steam tracer lines, meter boxes, steam mains, separators, small dryers, pipe coils, small unit heaters, etc.

POWER PLANTS on headers, fuel oil preheaters, compressed air lines, small steam jacketed fire pumps, etc.

HOSPITALS, SCHOOLS, HOTELS AND INSTITUTIONS on autoclaves, sterilizers, steam tables, washers, small pressure cookers, steam mains, etc.

LAUNDRIES on small presses, puff irons, sock forms, drying cabinets, starch cookers, steam mains, etc.

The 20-A has all the YARWAY Impulse Trap features such as small size, stainless steel body and working parts, low cost, non-freezing—and immediate availability through 270 local Industrial Distributors.

Write for Bulletin T-1739-X.

YARNALL-WARING COMPANY
153 Mermaid Avenue, Philadelphia 18, Pa.

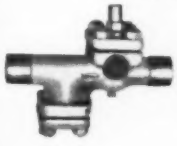
There's a Yarway Impulse Trap for every trapping need

SERIES 60 AND 120
For all *normal* trap requirements, pressures to 400 and 600 psi.

½" No. 20-A
For *light loads* on tracer lines, steam mains, small presses, etc.

SERIES 40
For *heavy loads* requiring extra high capacity steam traps.

INTEGRAL-STRAINER HIGH PRESSURE TRAP



For *high pressures, high temperatures.* (Flanged or welding connections.)

YARWAY IMPULSE® STEAM TRAP

OVER 1,000,000 YARWAY IMPULSE STEAM TRAPS USED

What is it?

It's a bubble-cap, encrusted with carbon, out of a fractionating tower just before in-place circulation cleaning with Oakite 85.

Recognize it now?

Same bubble-cap . . . after tower cleaning by Oakite chemical circulation methods that insure superior results with less down-time.

★ ★ ★

There's an Oakite specialized cleaning material for just about every maintenance cleaning job throughout the petroleum industry. For FREE 46-page booklet, "What Petroleum Men Should Know to Simplify Cleaning," write to Oakite Products, Inc., 50D Rector Street, New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE®
MATERIALS · METHODS · SERVICE
SCIENCE

Export Division Cable Address: Oakite

Technical Service Representatives in Principal Cities of U. S. and Canada

unions of the same design can be provided to withstand pressures up to 10,000 psi.

The new unions have two features: a true-ball seat and revolvable flanges. The true-ball seat prevents leakage even when there is considerable misalignment of pipe. The removable flanges make assembly much easier because the bolts and bolt holes are readily positioned. The manufacturer claims the union can be reassambled many times while retaining its original sealing qualities. It is available in pipe sizes from ⅛ to 6 in. **Almar Hydraulic Valve Co.,** 10011 Meech Ave., Cleveland 5, Ohio.

Circle No. **32** *on Reply Card*

Custom Thermometer

. . . is calibrated to a single point, with no variation plus or minus. The calibration point may be between —40° and 1000°F, or between —10° to +300°C.

The thermometer is calibrated accurately to a specified temperature point that is printed on the face of the dial. A notarized certificate of calibration is furnished with each instrument showing date of calibration and attesting to the 100% accuracy.

Stem lengths of the thermometers vary from 2½ to 70 in. The dial housing measures 1-11/16 in. The

From Regina to Saudi Arabia

B-L VESSEL LININGS SET RECORD AFTER RECORD FOR DEPENDABLE PERFORMANCE

It looks like a Cook's Tour—but it isn't. Instead it's a listing of recent Bigelow-Liptak refinery installations in far-flung corners of the world.

There are good, solid reasons for this world-wide preference for Bigelow-Liptak jobs. In the first place from B-L's years of experience has come a complete castable package. Insulating- and abrasion-resistant castables are engineered, furnished and installed by the same company—which means just one contract and one responsibility.

The overall result of this all-in-one engineering is exceptional durability and performance. B-L refractory installations have established world records for continuous operation. For example, after initial runs of 785 and 610 days, B-L linings were in perfect shape—required no repairs during shutdowns.

Yes, from Regina to Saudi Arabia—and points in between—Bigelow-Liptak installations are setting new records for service and performance. For complete information write for the B-L catalog "One Source". Do it today!

A FEW OF OUR RECENT JOBS

Montreal, Canada	Regenerator
Regina, Canada	Regenerator and Cyclones
Batangas, Philippines	Regenerator and Cyclones
Yokohama, Japan	Regenerator and Cyclones
Ras Tanura, Saudi Arabia	Regenerator—Reactor
Copenhagen, Denmark	Kiln-Reactor
Antwerp, Belgium	Kiln
Norco, La.	Regenerator and Cyclones
Altona, Australia	Reactors
Mandan, North Dakota	Regenerator and Cyclones
Anacortes, Washington, U. S. A.	Regenerator, Reactor, Cyclones and Lines.

BIGELOW-LIPTAK *Corporation*

AND BIGELOW-LIPTAK EXPORT CORPORATION
2550 WEST GRAND BOULEVARD, DETROIT 8, MICHIGAN

UNIT-SUSPENDED WALLS AND ARCHES

In Canada: BIGELOW-LIPTAK OF CANADA, LTD., *Toronto, Ontario*

ATLANTA • BOSTON • BUFFALO • CHICAGO • CLEVELAND • DENVER • HOUSTON • KANSAS CITY, MO. • LOS ANGELES • MIAMI • MINNEAPOLIS • NEW YORK • PHILADELPHIA • PITTSBURGH • PORTLAND, ORE. • ST. LOUIS • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SEATTLE • TULSA • MONTREAL • SAULT STE. MARIE, ONT. • VANCOUVER • WINNIPEG

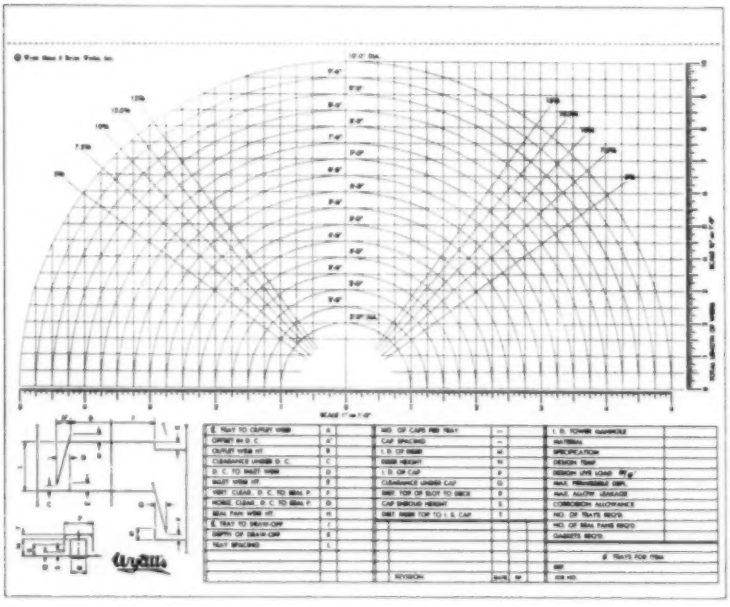
and Now! ----CARTAGENA, COLOMBIA

All of the castable refractories required for a complete cat cracker—including a regenerator and reactor and the interconnecting lines—will be furnished by Bigelow-Liptak for a job now going up at Cartagena, Colombia. In addition, B-L will furnish erection help and supervision.

FOR QUICK TRAY LAYOUTS

Each Binder, 10 x 11½ inches, contains a pad of 50 transparent layout sheets, nine cap layout cards and instructions, so the process engineer can within minutes layout bubble cap trays from 2 through 10 feet in diameter.

All material is copyrighted by Wyatt Metal & Boiler Works, which will supply pads of transparent worksheets at no additional cost.



$15.00 *EACH*

Wyatt Metal & Boiler Works
P.O. Box 3052
Houston, Texas

Please forward _____ Easy Tray Layout Binders to

Name _____

Firm _____

Address _____

Check herewith _____ Send Statement

crystal is curved. All parts except the totally enclosed dial are made from type 304 stainless steel. **W. C. Dillon & Co., Inc.,** P.O. Box 3008, Van Nuys, Calif.

Circle No. **33** *on Reply Card*

Pneumatic Valve

. . . **handles gases** up to 10,000 psi pressure, and at temperatures from 40° below to 400° F.

Designed to handle gases such as air, argon, helium and nitrogen under extreme conditions, this fast-acting pneumatically operated valve is small in size, measuring 10½ x 11⅝ in. It has a stainless steel body and split-body construction with clamped-in seat ring. **Minneapolis-Honeywell,** valve Division, 435 N. Broad St., Philadelphia, Penn.

Circle No. **34** *on Reply Card*

Portable pH Recorder

. . . **requires no external power** supply. It can be used for field surveys of stream pollution, waste-treatment plant

to meet exacting lubrication standards, specify

ENJAY PARATONE®

viscosity-index improver

Refiners and blenders rely on Enjay Paratone for compounding oils that combine cold-weather, quick-starting properties with low consumption characteristics.

You can also count on Enjay for a prompt solution to your additive problems. The Enjay Company, pioneer in petroleum additives, has extensive experience in working with oil companies and leading engine manufacturers to develop additive formulations. Whatever your use of additives, you can benefit from this experience.

For complete information, write or call the Enjay Company—your only source of a *complete* line of additives (Paramins®) for fuels and lubricants.

ENJAY

Pioneer in Petrochemicals

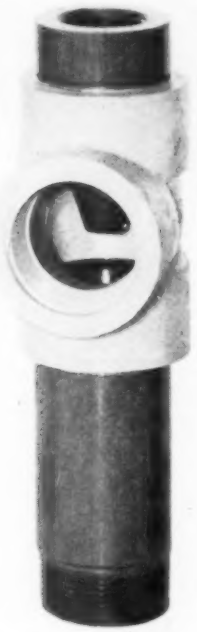
ENJAY COMPANY, INC., **15 WEST 51st STREET, NEW YORK 19, N. Y.** • Other offices: Akron, Boston, Chicago, Tulsa

effluent, water supplies and in-plant problems.

The device consist of two units: a Bristol Model 524 pH recorder and a Beckman N-2 amplifier. This equipment covers the total range pH of 0-14 in two partial ranges—from 0-8 and 6-14. Range selection is by switch located on the amplifier. The permanent record is on carbon-coated 8-in. diameter charts, with the record made by a vibrating-type stylus. The chart drive can rotate the chart in either 1 or 24 hours.

The two units together weigh less than 50 lb. Various types of electrodes are available, including those for immersion, flow, and laboratory applications. **The Bristol Co.,** Waterbury 20, Conn.

Circle No. **35** *on Reply Card*



PVC Jet Eductors

. . . with exceptional resistance to many corrosive materials operate at a maximum pressure of 125 psi and a temperature of 160°F.

Designed for use in liquid pumping and mixing operations. These jet eductors can also be used for handling small-size particles of dry solids. The polyvinyl chloride material is resistant to many refinery chemicals and compounds—alcohols, ammonia, chlorine, copper sulfate, sour crude and many others. However, PVC eductors are not resistant to acetone, ketones, ethers, esters, or aromatic or chlorinated hydrocarbons.

Six standard sizes are available, ranging from ½ to 3 in., with

metallo

prime manufacturers of

RASCHIG and LESSIG RINGS

From Inventory or Custom Designed To Your Specifications

When you are in the market for Metal Raschig and Lessig Rings, buy from a primary source — Metallo the Manufacturer. Buy Metallo Raschig and Lessig Rings because it pays off in dividends of extra savings in time and money. 37 years experience assures you of top quality, top performance and lowest possible prices.

metallo metallic raschig rings

Develop greater production capacity because they offer highest possible contact surfaces, high scrubbing capacity, thorough dispersion of gases and liquids and long life. Metallo Metal Raschig Rings do not crumble regardless of pressure or acid content. Furnished in all metals. Samples on request.

metallo metallic lessig rings

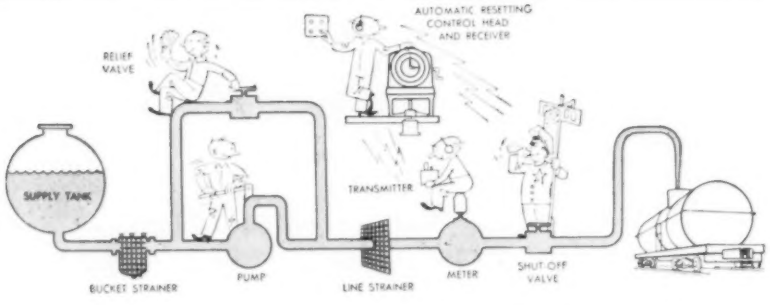
Act as efficient liquid distributors by eliminating cross flows. They also offer greater pressure drops than Raschig Rings but offer lower pressure drops than Ceramic Rings. Thus, Metallo Metal Lessig Rings develop greater production through increased contact surfaces. They will not break or crumble. Furnished in all metals. Samples on request.

QUICK DELIVERY ON ALL QUANTITIES

Write for complete information, specifications and prices.

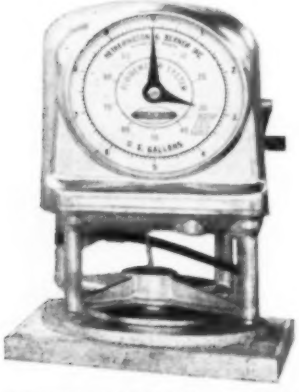
metallo gasket co.

12 BETHANY STREET • NEW BRUNSWICK, N. J.



TYPICAL REMOTE CONTROL FLUIDOMETER SYSTEM

For Use Where Valves Must Be Located In Hard-to-get-to Places



This animated picture illustrates a typical remote control Fluidometer application. Remote control of this general type is recommended when plant conditions or arrangement make direct control impractical or impossible. With a system of this type the Fluidometer control head can be located away from the meter. Shown at the left is the automatic resetting control head, which controls the operation of the shut-off valve to give completely automatic batching. Available either jacketed or unjacketed—"tailor made" to fit your needs. New Bulletin Fl-56 will be sent on request. For information on jacketed pipe and fittings write for Bulletin J-56.

HETHERINGTON & BERNER INC. • *ENGINEERS-MANUFACTURERS*

715 KENTUCKY AVENUE INDIANAPOLIS 7, INDIANA

how much could you add to your profit-- by saving $50,000 per boiler cleaning?

Here's An Example Of Such A Savings Made Possible By Dowell Chemical Cleaning Service

Dowell recently chemically cleaned a 1,000,000 lb. per hour steam generator for one of its customers. Total outage time was 48 hours. This saved the company an estimated five to seven days down-time, as compared to mechanical cleaning methods.

Considering replacement power for a boiler of this capacity costs between $7,000 and $15,000 per day, it's easy to see a $50,000 savings. And, it's just as easy to project a $250,000 to $500,000 annual savings for a plant with five to ten such boilers.

This particular case history concerns a power company with a forward-looking operations manager. But, Dowell has other startling performance data to show you — from your own industry. That's because chemical cleaning is so versatile. Dowell engineers are experts in removing scale and sludge from process systems, tanks and piping. They apply solvents in various ways— such as filling, jetting, cascading. Dowell furnishes all the necessary chemicals, trained personnel, pumping and control equipment.

For specific information on how chemical cleaning can help you to greater profits, call the Dowell office near you. Or write Dowell Incorporated, Tulsa 1, Oklahoma.

have Dowell clean it chemically DOWELL

A SUBSIDIARY OF THE DOW CHEMICAL COMPANY

Not a Secret Vise!

Known Everywhere As Extra-handy and Rugged

RIDGID Bench Pipe Vise—8 sizes for ⅛" to 6" pipe

RIDGID

More-for-your-money pipe vises

Easy to Work With—LonGrip jaws for firmer pipe grip *plus* pipe rest for accurate threading and cutting. Built-in handy pipe bender—a time saver . . .

Years of Service—Replaceable long-life tool-steel jaws. Yoke and base of special tough malleable . . . Same quality in all RIDGID vises, yoke and chain.

Order from your Supply House!

RIDGID Work-Saver Pipe Tools

The Ridge Tool Company, Elyria, Ohio, U.S.A.

threaded connections. Performance characteristics are similar to metal eductors of equivalent size. Dept J-Y, **Schutte and Koerting Co.,** Cornwells Heights, Bucks County, Pa.

Circle No. **36** *on Reply Card*

Evaporation Barrier

. . . of polyethylene floats on the surface of volatile liquids and prevents loss of tank-stored products.

Called "Agile Mini-Vaps," these small and irregular shape floats contain thousands of tiny air cells for buoyancy. Made of polyethylene, the Mini-Vaps have good resistance to chemicals and solvents and cannot be punctured or broken. Their special surface contour is designed for extensive interlocking and clustering at the liquid surface.

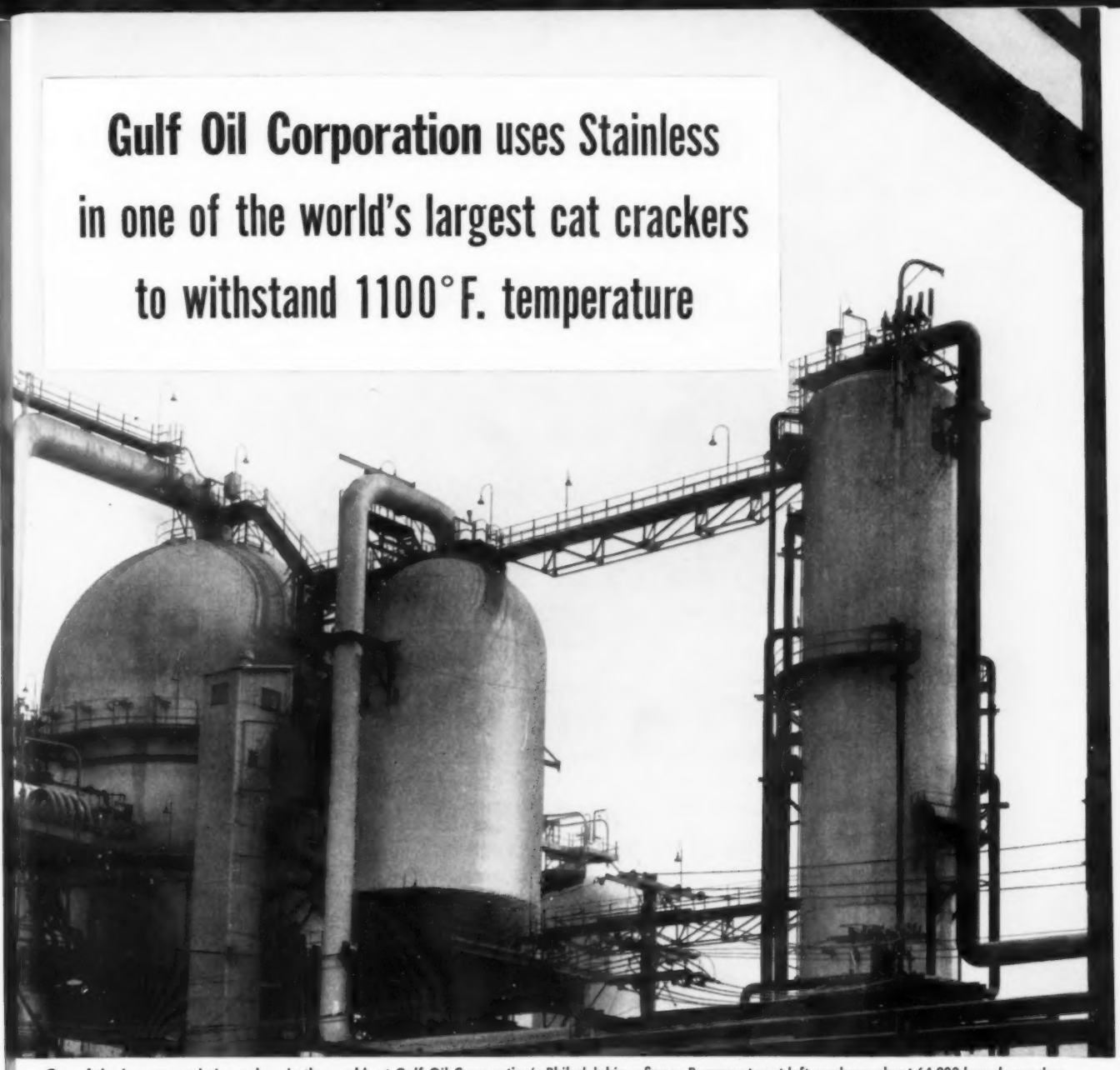
Bulk density of the floats is 17 lb/cu ft; material density is 35/cu ft. The Mini-Vaps measure between ¼ and ½ in. thick. **American Agile Corporation,** 5461 Dunham Road, Maple Heights, Ohio.

Circle No. **37** *on Reply Card*

Optimal Controller

. . . **automatically controls** operating conditions at optimum performance

Gulf Oil Corporation uses Stainless in one of the world's largest cat crackers to withstand 1100° F. temperature



One of the largest catalytic crackers in the world, at Gulf Oil Corporation's Philadelphia refinery. Regenerator at left produces about 64,000 barrels per day.

IN ITS PHILADELPHIA REFINERY, Gulf operates one of the world's largest catalytic cracking units. It produces high octane gasoline, heating oils, fuel gas, gas oil, propane-propylene and butane-butylene. Capacity is about 64,000 barrels per day. 9 million pounds of catalyst circulate each hour, and the unit consumes nearly 400,000 pounds of steam per hour.

The top of the spherical regenerator is shingled with 14-gage Stainless Steel strip. Temperature reaches about 1100° F. in the burning atmosphere, and the Stainless Steel shingles resist erosion caused by the pressure circulation of the catalyst, which has the consistency of talcum powder. Carbon steel shingles would deteriorate and fail rapidly. Bottom section and cone of the fractionating tower (right) are lined with Stainless Steel to withstand corrosion at high (700° F.) temperature.

Stainless Steel gives you the most for your money when it is designed *into* equipment, right from the start. So think of Stainless Steel when you design. Think of *USS* Stainless when you buy.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO · NATIONAL TUBE DIVISION, PITTSBURGH
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALABAMA
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
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USS STAINLESS STEEL

SHEETS · STRIP · PLATES
BARS · BILLETS

USS

PIPE · TUBES · WIRE
SPECIAL SECTIONS

UNITED STATES STEEL

Thirty Million B.T.U. CAPACITY

Cooling in Chemical Processes with Precise Control of Temperature

The NIAGARA Aero HEAT EXCHANGER cools liquids and gases by evaporative cooling with atmospheric air, removing the heat at the rate of input, controlling temperature precisely. You save 95% of cost of cooling water; you make great savings in pumping, piping, power; quickly recover your installation cost.

You can cool and hold accurately the temperature of all fluids, air and gases, water, oils, solutions, chemical intermediates, coolants for mechanical, electrical and thermal processes. You obtain closed system cooling free from dirt. You solve all the problems of water availability, quality or temperature.

In CHEMICAL PROCESSES this is successfully used in cooling liquids and gases, chemical reactions, condensing distillations and reflux cooling.

Write for complete information; ask for Bulletins 120 and 124. Address Dept. PP.

NIAGARA BLOWER COMPANY

405 Lexington Ave. · New York 17, N. Y.

District Engineers in Principal Cities of United States and Canada

regardless of changing external conditions.

This instrument is based on a new control concept for maintaining operating conditions on the slope of an operating curve, using the curve as the control parameter. It combines many features found in conventional process controllers with some of the logical devices of analog computers.

Typical applications are: maximizing fuel cost of a tanker by control of engine power setting; optimum cost control of a distillation column by balancing lost overheads against the cost of steam used; or maintaining minimum fuel consumption in a boiler by holding constant temperature while the Optimal Controller maintains air-fuel ratios.

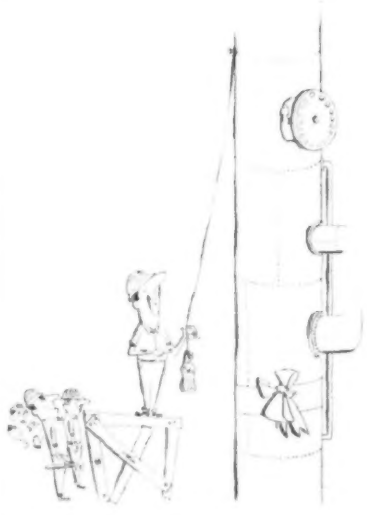
The instrument is mounted in either weather-tight or explosion-proof cast aluminum cases; or in an all steel case. Two ranges of process stabilization time are available, ½ to 30 min. and 5 min to 5 hours. Slope control is fully adjustable for either positive or negative slope, near either maximum or minimum, and with slope from zero to 2.5:1 when the maximum output increment is 10% of the adjustment range. **Quarie Controllers,** Canton, Mass.

Circle No. **38** *on Reply Card*

Vapor Concentration

. . . of hydrocarbons in air can be measured accurately with a special device called Saturation Factor Indicator. Similar in appearance to a portable combustible gas indicator, the instrument directly reads the percent

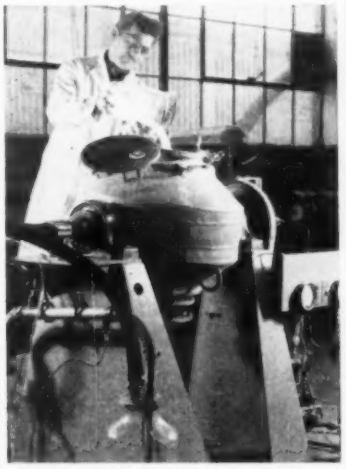
• • •



Corrosioneering News

Quick facts about the services and equipment available to help you reduce corrosion and processing costs.

Published by The Pfaudler Co., Rochester, N.Y., U.S.A.



PRETEST YOUR PRODUCT FREE in this Pfaudler pilot plant glassed steel dryer-blender. This standing offer has enabled many chemical manufacturers to predict performance on new materials or compare operation with conventional equipment. Complete reports are furnished or you can send your own man to observe results. To date, Pfaudler units have reduced drying and blending cycles drastically over previous methods. For an appointment, call your nearest Pfaudler office or use coupon, if preferred.

New wiped-film evaporator uncovers greater profit areas

To industries employing vacuum distillation, this improved evaporator offers low-cost development opportunities.

Higher heat transfer rates and faster evaporation contribute to greater profits and purer distillates. If product purity, speed and profit are uppermost in your field, compare this new Pfaudler unit with your present equipment. It offers these important benefits:

Higher heat transfer for even highly viscous products.

Shorter contact time – as low as a fraction of a second–prevents deterioration of heat sensitive substances.

Uniform film thickness–prevents fouling and solids buildup.

Low operating pressure–from atmospheric to a fraction of a millimeter.

Minimum pressure drop – less than 1/10 millimeter of mercury at one mm Hg operating pressure.

Write for Data Sheet 39.

Emergency at Gamma Chemical met by 3-day delivery of 500-gallon reactor

When extra processing capacity was urgently needed recently at Gamma's Great Meadows plant in New Jersey to custom process a new organic chemical, Gamma called Pfaudler and asked how fast a 500-gallon reactor could be shipped.

"How about the day after tomorrow," countered Pfaudler. "Sold!" said Gamma. Waiving the normal ten-day delivery schedule, Pfaudler rushed a standard unit through the shop even before the customer's written order arrived. The emergency was met–a 500-gallon glassed steel reactor was shipped–in just *three days' time!*

Gamma Chemical's plight points up one of the ways you can benefit from Pfaudler's policy of stocking standard glassed steel reactors. Fast delivery provides only one of the savings, however. You can also cut initial costs by eliminating special engineering drawings, special parts and material custom-designed units require.

You get an adaptable, corrosion-resistant reactor whenever you specify a standard Pfaudler glassed steel vessel – resistant to all acids (except HF) and alkaline solutions up to pH12. Each reactor is completely assembled and ready to ship within two weeks from receipt of your order.

Take advantage of Gamma Chemical's experience and check with Pfaudler before you buy your next reactor. Contact your Pfaudler representative for more information on standard reactors. Units stocked for ten-day delivery include the following capacities: 30, 50, 100, 200, 300, 500, 750, 1000 and 2000 gallons. Check the coupon for sizes in which you are interested.

READY TO GO. A standard 500-gallon reactor is readied for quick shipment to Gamma Chemical. This vessel was on its way to Gamma's Great Meadows plant even before a written order had arrived!

THE PFAUDLER CO., Dept. PP-1, Rochester 3, N.Y.

Please send me ☐ Wiped-Film Evaporator Data Sheet 39 ☐ Dryer-Blender Data Sheet 26 ☐ Standard Glassed Steel Reactors, Bulletin 860.

Name.....

Title.....

Company.....

Address.....

City..... Zone..... State.....

(To obtain more data on advertised products see page 132)

users say

Chemiseals pay

in longer trouble-free life---

Customers report unsurpassed performance in the following applications.

CONCENTRATED H_2SO_4 ACID	Aurora Pump. 1750 r.p.m. 1 9/16 inch shaft. 2 lbs. suction. 45 lbs. discharge. Temperature of medium 65°C. Not flushed.
UREA-WATER SOLUTION	Ingersoll-Rand Pump. 1750 rpm. 1 1/8 inch shaft. 2 lbs. suction. 35 lbs. discharge. Temperature of medium 100°C. Not flushed.
HYDROCARBON FEED	Labour Pump. 1750 rpm. 1 1/8 inch shaft. 10 lbs. suction, 25 lbs. discharge. Temperature of medium 102°C. Not flushed.
ADIPIC ACID and HYDROCARBON SLURRY	Labour Pump. 1750 rpm. 1 1/8 inch shaft. 35 lbs. suction, 75 lbs. discharge. Temperature of medium 70°C. Seal flushed.
UREA-NH_3 SOLUTION	Ingersoll-Rand Pump. 3600 rpm. 1 1/8 inch shaft. 10 lbs. suction, 50 lbs. discharge. Temperature of medium 75°C. Not flushed.
ESTER (10% Solids)	Byron Jackson Pump. 3600 rpm. 625 lbs. discharge. 30 lbs. suction. Stuffing box pressure 15 lbs. to 65 lbs. Temperature of medium 70°C. Seal flushed.
HYDROXYACETIC and SULFURIC ACID	Allis-Chalmers Pump. 1750 rpm. 1 1/2 inch shaft. 10 lbs. suction, 60 lbs. discharge. Temperature of medium 30°C. Not flushed.

What are your shaft sealing problems? Write for Bulletin MS-1155.

UNITED STATES GASKET CO.

CAMDEN 1, NEW JERSEY

saturation up to 40% of hydrocarbons in air.

Electrically operated, the instrument is "intrinsically safe" for use around petroleum tanks. It operates on a modified thermal conductivity principle from 10 flashlight batteries. Samples of the vapor are drawn through the instrument by a standard aspirator bulb.

When calibrated to a standard reference temperature, the instrument will give a direct reading of "percent saturation." The saturation can be related to any desired temperature. Typical applications include measuring the vapor concentration of exhaled tank vapors (evaporation loss studies), determining vapor stratification within a tank, and air pollution studies. **Johnson-Williams, Inc.,** Palo Alto, Calif.

Circle No. **39** *on Reply Card*

Polyethylene Tape

. . . **protects pipe** against corrosion, preventing electrolytic attack and microbiological deterioration.

Wrapped on the pipe by either manual or mechanical means, the plastic tape permits little or no moisture absorption or penetration. No special conditioning with heat is required. A non-corrosive compound on one side of the tape bonds it to the pipe or another layer of the tape.

Safe-T-Clad tape is available in 100-ft rolls, in either 1, 2, 4, or 6-in. widths. Industrial Tape Division, **Seamless Rubber Co.,** New Haven 3, Conn.

Circle No. **40** *on Reply Card*

Free Trade Literature

Copper Removal

. . . from steam generating units will extend operating life: *Development Bulletin on Copper Removal* describes

Specify SQUARE D Motor Starters for 3 Important Reasons

Easy to Wire!

Plenty of wiring space.
Handy solderless terminals.

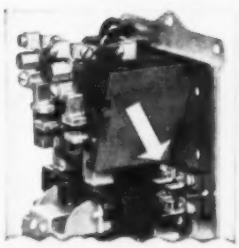
Easy to Get At!

Coils, contacts or overload relays can be changed in no time at all—without disturbing external connections.

Easy to Live With!

Straight line guided motion minimizes wear; large silver alloy contacts insure trouble-free electrical performance.

"Off-the-Shelf" Parts Kits make normal maintenance easier than ever. Each kit contains parts necessary to replace all load contacts and finger springs. An illustrated service bulletin is enclosed to provide quick parts identification and complete installation instructions.



ELECTRICAL INTERLOCKS are available in kit form. Practically any necessary number or arrangement of extra interlock contacts can be added to any standard starter. Sizes 2 and 3 starters have new front-of-panel mounting interlocks for faster, easier installation. *(See cutaway at left)*

***Write** for Bulletin 8536*

Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY

(To obtain more data on advertised products see page 132)

LESS "LOST TIME" with AIRETOOL

You'll keep plant production and efficiency way up... practically eliminate costly downtime due to tube failure, with AIRETOOL Condenser Tube Maintenance equipment. Even at "turn-a-round" time, lost stream time is kept to a minimum. Repair, removal and replacement of tubular equipment is accomplished faster, easier and at less cost, with AIRETOOL equipment on the job.

Don't wait... investigate all the advantages of AIRETOOL Condenser Tube Maintenance Equipment now. There's a precision built AIRETOOL tube maintenance tool for every type of tubular construction. See your nearest AIRETOOL Representative today... or write AIRETOOL MFG. CO., Springfield, Ohio, for information.

NEW INTERNAL TUBE CUTTER
quickly removes damaged or leaky tubes. Cuts through steel or non-ferrous tube sheets to 4" thick. Air or electric driven motor.

NEW PUSH-TYPE INTERNAL TUBE CUTTER
for non-ferrous tubes 5/8" to 1" O.D. cuts through tube sheets 1" to 4" thick. Operates on your own air or electric motor.

CONDENSER CLEANERS
outside mounted, direct or gear driven. Powerful... fast... lightweight... for lightly scaled or completely plugged tubes. Built in flushing system cools drill, removes cuttings.

CONDENSER TUBE EXPANDERS
parallel rolling, self-feeding, ball bearing thrust. Rolls tubes to uniform thickness, with maximum bonding.

AIRETOOL MIDGET CLEANERS
for lightly scaled tubes. Small, powerful, excellent for cleaning small tubes with extremely short radii turns or hairpin bends.

Send for Bulletin #59, illustrating the complete new line of AIRETOOL Tube Cutters, cleaners, expanders, accessory and specialty tools.

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

BRANCH OFFICES: New York, Chicago, Tulsa, Philadelphia, Houston, Baton Rouge.
REPRESENTATIVES: in principal cities of U.S.A., Canada, Mexico, South America, England, Europe, Puerto Rico, Italy, Japan, Hawaii.
EUROPEAN PLANT: Vlaardingen, The Netherlands.
CANADA PLANT: 37 Spalding Dr., Brantford.

the problem that is frequently encountered in power house equipment of copper particles depositing on heat transfer surfaces. If not removed they may cause pitting, hot spots, or even slough off in a film and plug the tubes. This bulletin describes tests made with a new copper-removal agent. Dowell Inc., Box 536, Tulsa, Okla.

Circle No. **41** *on Reply Card*

Fresh Water

. . . produced by electric membrane demineralization: *Bulletin #3* describes the equipment used in removing dissolved solids from salt or raw water, making it usable for drinking or industrial uses. This method moves the dissolved salts by an electric current, through special membranes, out of one stream which is being desalted, and into a second stream, which becomes discarded brine. Capacities of one unit range up to 28,000 gal/day. Ionics, Inc., 152 Sixth St., Cambridge 42, Mass.

Circle No. **42** *on Reply Card*

Butyrate Plastic Pipe

. . . its properties and applications: a reprint of a paper presented at the Society of Plastics Engineers Technical Conference. This bulletin lists the many industrial applications for cellulose acetate butyrate pipe, and includes descriptions of the chemical composition, physical and chemical properties and test data on pipe and fittings made from this plastic material. Eastman Chemical Products, Inc., Kingsport, Tenn.

Circle No. **43** *on Reply Card*

Digital Computing

. . . and how to understand its language: a booklet titled *Symbolic Logic, Binary Calculation and 3C-PACs* is a primer on digital computation that should help clarify the important rudiments of this new tool. The booklet describes the simple rules of symbolic logic, showing how most of the calculations are based upon a system of binary, rather than decimal, numbers. Computer Control Co., Inc., 92 Broad St., Wellesley 57, Mass.

Circle No. **44** *on Reply Card*

Fluor Research

. . . and the available facilities: *Brochure 103-2M-956* describes the Fluor Corp.'s research facilities which are now available for contract use in solving chemistry, chemical engineering, physics and mechanical engineering problems. Pilot plants for refinery processes, high pressure chemical proc-

Inside Story on POWELL STEEL VALVES

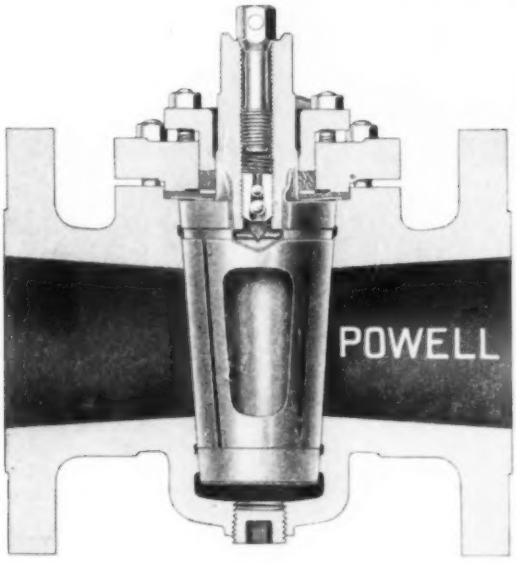


FIG. 3059--(Sectional)--A.S.A. 300-pound Steel Lubricated Plug Valve.

FIG. 2456 SS--OS&Y Gate Valve--1/16 Raised Face Separate Yoke Arms. Flanges are in accordance with ASA B16.5.

Steel Valves may appear similar on the outside. But their performance may be quite another story--for there can be a big difference in the metal, in design and in manufacture. And the inside story on Powell Steel Valves is that every valve has PERFORMANCE VERIFIED.

Only the finest materials are used in Powell Steel Valves. And painstaking quality control is rigidly enforced through each step of manufacture. For example, every machining operation is accurately gauged. All parts are thoroughly cleaned and degreased. As a final step in manufacture, EVERY POWELL STEEL VALVE IS GIVEN AN ACTUAL LINE TEST.

Because of Powell's painstaking quality control, plant shutdown through valve failure is practically unknown. Records from refineries, power and industrial plants the world over prove it.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our COMPLETE quality line which has PERFORMANCE VERIFIED.

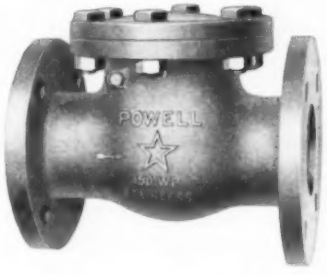


Fig. 2433 SS--Stainless Steel Bolted Cap Swing Check Valve for 150 pounds W.P.

PERFORMANCE PV VERIFIED

The Wm. Powell Company, Cincinnati 22, Ohio . . . 111th YEAR

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American Bitumuls & Asphalt Company

200 Bush Street, San Francisco 20, California. Perth Amboy, N. J.
Baltimore 3, Md. St. Louis 17, Mo. Cincinnati 38, Ohio
Mobile, Ala. San Juan 23, P. R. Tucson, Ariz.
Inglewood, Calif. Oakland 1, Calif. Portland 7, Ore.

LEADING MARKETERS OF ASPHALTS, CUTBACKS AND BITUMULS – NATIONWIDE

essing, as well as experimental compressor installations and a granulation plant, are some of these facilities now available. Research Division, The Fluor Corp., Ltd., 12000 East Washington Blvd., Whittier, Calif.

Circle No. **45** *on Reply Card*

Petroleum Processing Index

. . . for 1956: includes subject and author indexes for all feature articles and regular departments published during the past year. Available now from McGraw-Hill Petroleum Publications, 330 West 42nd St., New York 36, N. Y.

Circle No. **100** *on Reply Card*

Gas Analysis

. . . by thermal conductivity will determine the ratio of two individual gases: *Bulletin TD-507* describes a custom-made instrument designed to meet particular applications. Based on the difference in thermal conductivity of a gas—related to that of a known gas—this instrument will measure the ratio of gases in a binary mixture such as nitrogen in hydrogen for ammonia synthesis. Arnold O. Beckman, Inc., 1020 Mission St., So. Pasadena, Calif.

Circle No. **47** *on Reply Card*

Air Pollution

. . . and the methods for studying it and controlling it: *Tools and Techniques in Air Pollution Control* is a description of scientific methods which this consulting group can use for studying air pollution problems. They include pilot scale research, wind tunnel models, new-plant surveys, dust collector testing, micrometeorological studies and many others. Hemeon Associates, 121 Meyran Ave., Pittsburgh 13, Penn.

Circle No. **48** *on Reply Card*

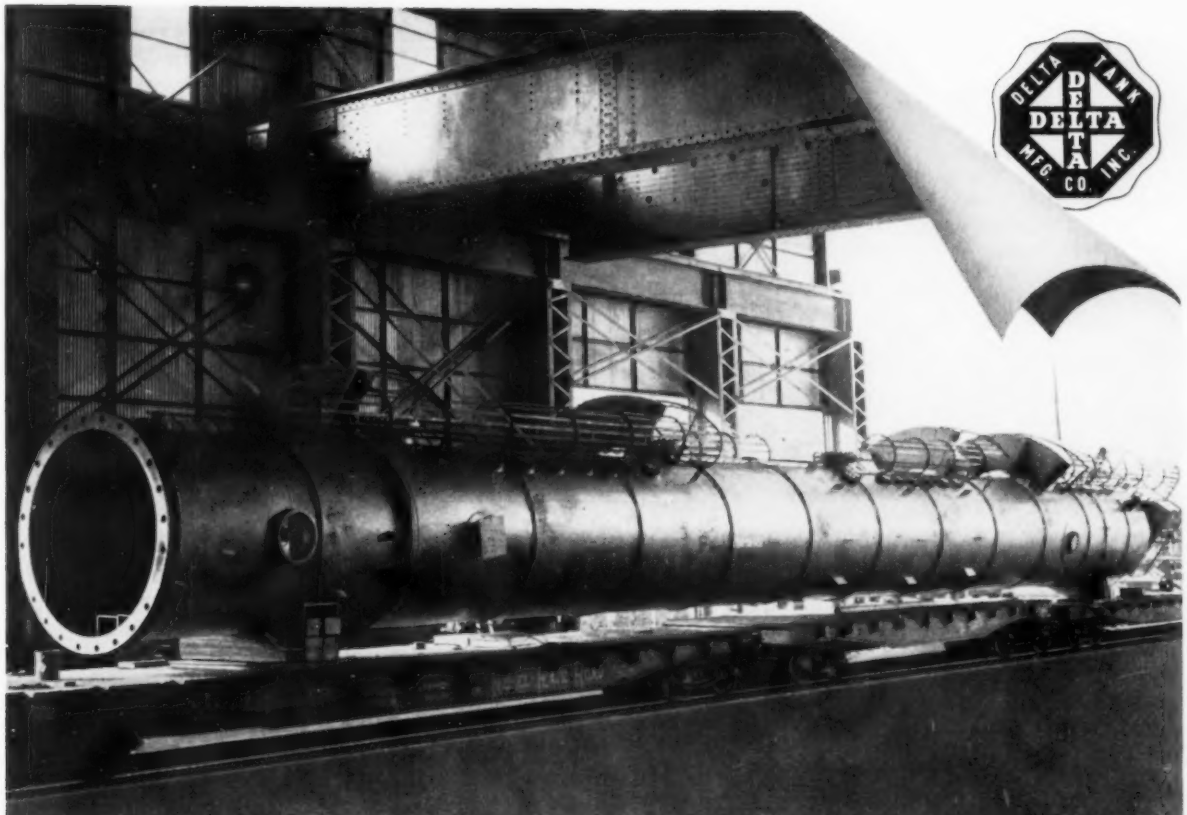
Aluminum Jacketing

. . . for tanks, vessels, and piping systems: *Kaiser Aluminum Insulation Jacketing Materials and Methods*, a 40-page publication, gives complete recommendations for selecting, fabricating and installing aluminum jacketing. Basic engineering data for determining material required for an insulation job is included. Kaiser Aluminum & Chemical Sales, Inc., Process Industries Dept., PR-1256, 1924 Broadway, Oakland 12, Calif.

Circle No. **49** *on Reply Card*

Homogenizer-Mixer

. . . for a wide range of processing operations: *Catalog No. 402-R-2* de-



You should see what's inside!

This depropanizer fabricated for a Gulf area customer is 102" I.D. x 1-5/16" x 95'. It weighs 242,628 pounds and was shipped in one section. Another example of the engineering skill and fabrication experience available at Delta to meet your pressure equipment requirements.

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Complete information on Delta's facilities, or your specific equipment needs, is available at your request.

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(To obtain more data on advertised products see page 132)

scribes the blending action of this high speed and high shear mechanism, which subjects materials to intense forces of impact and hydraulic shear. Drawings and photographs of the Eppenbach Homo-Mixer show its internal construction and demensions. Gifford-Wood Co., Graybar Building, New York, N. Y.

Circle No. **50** *on Reply Card*

"Engineering For Eddie"

. . . is a sound film prepared by Ohio State University. It has been prepared to help youngsters and parents in evaluating engineering as a career. The film is available on a free-loan basis or for purchase from the Department of Photography, Motion Picture Div., Ohio State University, Columbus 10, Ohio.

Circle No. **51** *on Reply Card*

Infrared Analyzer

. . . for a single component in a mixture of liquids or gases: *Bulletin No. 0705-2* describes a recent inexpensive model developed for industrial processing. It will solve many problems needing a quick but accurate analysis of a single component. Accuracy is 1% of full scale, and the instrument can be used for batch or continuous processing. Mine Safety Appliance Co., 201 N. Braddock Ave., Pittsburgh 8, Pa.

Circle No. **52** *on Reply Card*

Sulfur Resistant Pipe

. . . for high temperature service: *Technical Data Card 146-A* offers up-to-date information on chromium molybdenum alloy stell pipe, tubes and fittings. B&W Croloy 5 is resistant to H_2S, elementary sulfur and organic sulfur compounds at the elevated temperatures found in petroleum processing. Babcock & Wilcox Co., Tubular Products Div., Beaver Falls, Penn.

Circle No. **53** *on Reply Card*

Pipeline Engineering

. . . by use of a computer: *Application Report No. 2* describes how a complex construction problem on a natural gas pipeline was solved with a Bendix Computer. The equations and methods of computation involved in solving the source and destination pressures over a 300-mile pipeline are presented with the aid of diagrams. Bendix Computer, Division of Bendix Aviation Corp., 5630 Arbor Vitae St., Los Angeles 45, Calif.

Circle No. **54** *on Reply Card*

NI-VEE Bronzes

. . . their engineering properties and applications: *Booklet No. 3157 A-207* is a 25-page engineering report on the composition, characteristics and applications of these bronzes made by Inter-National Nickel Co. They include five alloys whose compositions pivot around 5% nickel and 5% tin, and may include lead and zinc. Outstanding properties include high strength, good fatigue endurance, corrosion resistance, and heat treatability. International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.

Circle No. **55** *on Reply Card*

Oil Industry Story

. . . written for popular appeal makes interesting reading for everyone: *The Industry Nobody Really Knows* is a 35-page report by Craig Thompson, a well known reporter, aimed at giving consumers of all petroleum products a realistic picture of the oil industry. The story includes personal sketches of several typical men in the in-

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If your operations require storage of compressed gases in bulk, it will pay you to put your storage facilities on wheels. The use of Taylor-Wharton Gas Transports enables you to move the supply to the point where it is needed at any particular time. Chemical, petrochemical, electronics and food processing companies operating their own gas producing plants, use these vehicles for inter-plant distribution of gases and for standby equipment.

Taylor-Wharton Gas Transports consist of specially constructed trailers in single and double axle models, mounted with a group of seamless steel storage pressure tubes made to ICC3A2400 specifications. The tubes are interconnected with valves and manifold to a common outlet in a weatherproof cabinet built on the rear of the trailer. Standard capacities range from 38,500 cu. ft. to 56,250 cu. ft. Other sizes as required.

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to keep it on the job

No need for a steam trap to be complicated. All it does is discharge condensate and air from steam lines and equipment. But its importance shouldn't be overlooked. On its effectiveness can rest your economical use of steam . . . the efficiency of your process operations.

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Bulletin 10-55

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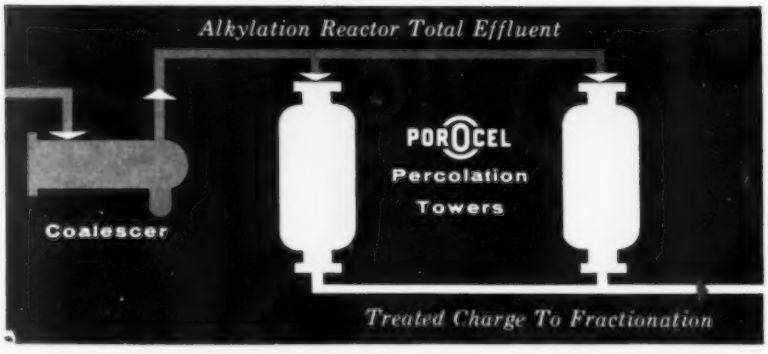
MIN CHEMISTRY *at work*

case: Alkylation throughput increased, maintenance cut, with Porocel percolation step



The flow sketch shows where sorptive treatment (technique developed by DX-Sunray Oil Co., and M. W. Kellogg Co.) takes place in DX-Sunray's Tulsa Alkylation Unit.

EQUIPMENT REPORT: Simple 2-tower system handles total H_2SO_4 reactor effluent—one on stream while Porocel in the other undergoes unique in-place regeneration.

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a. Removes more than 99% of acid and esters (caustic and water wash systems remove about 65%).
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c. Protects against maintenance troubles . . . permits pushing unit to higher capacity.
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What's New

dustry—the millionaire, the constant dry-holer, the successful service station operator, and others whose jobs depend on oil. A well-written and well-presented story of oil, this booklet is available from Gulf Oil Corporation, P.O. Box 1166, Pittsburgh 30, Pa.

Circle No. **56** *on Reply Card*

High Vacuum Pumps

. . . for the 10 mm to 0.1 micron range: *Catalog No. 752* includes specifications for the complete line of Stokes pumps. Also included are tables of formulas, constants and conversion factors frequently used in vacuum work. Solutions to typical vacuum system design problems are presented too. F. J. Stokes Corp., 5500 Tabor Road, Philadelphia 20, Penn.

Circle No. **57** *on Reply Card*

Magnetic Inspection

. . . for finding cracks and other defects: *Form 151* is a non-technical explanation of the techniques of magnetic particle inspection—what it is, how it works, and where it can be applied. Included are many pictured examples of this non-destructive test method as used in different industries. Magnaflux Corp., 7300 W. Lawrence Ave., Chicago 31, Ill.

Circle No. **58** *on Reply Card*

Lubricant Additive

. . . lowers wear rates of metal surfaces under extreme conditions: *Bulletin Lu-6* summarizes the lubricating characteristics of Moly-Sulfiide-containing lubricants as demonstrated by standard tests. Information on field and laboratory tests for many special applications are presented. Climax Molybdenum Co., 500 Fifth Ave., New York 36, N. Y.

Circle No. **59** *on Reply Card*

Operation Manual

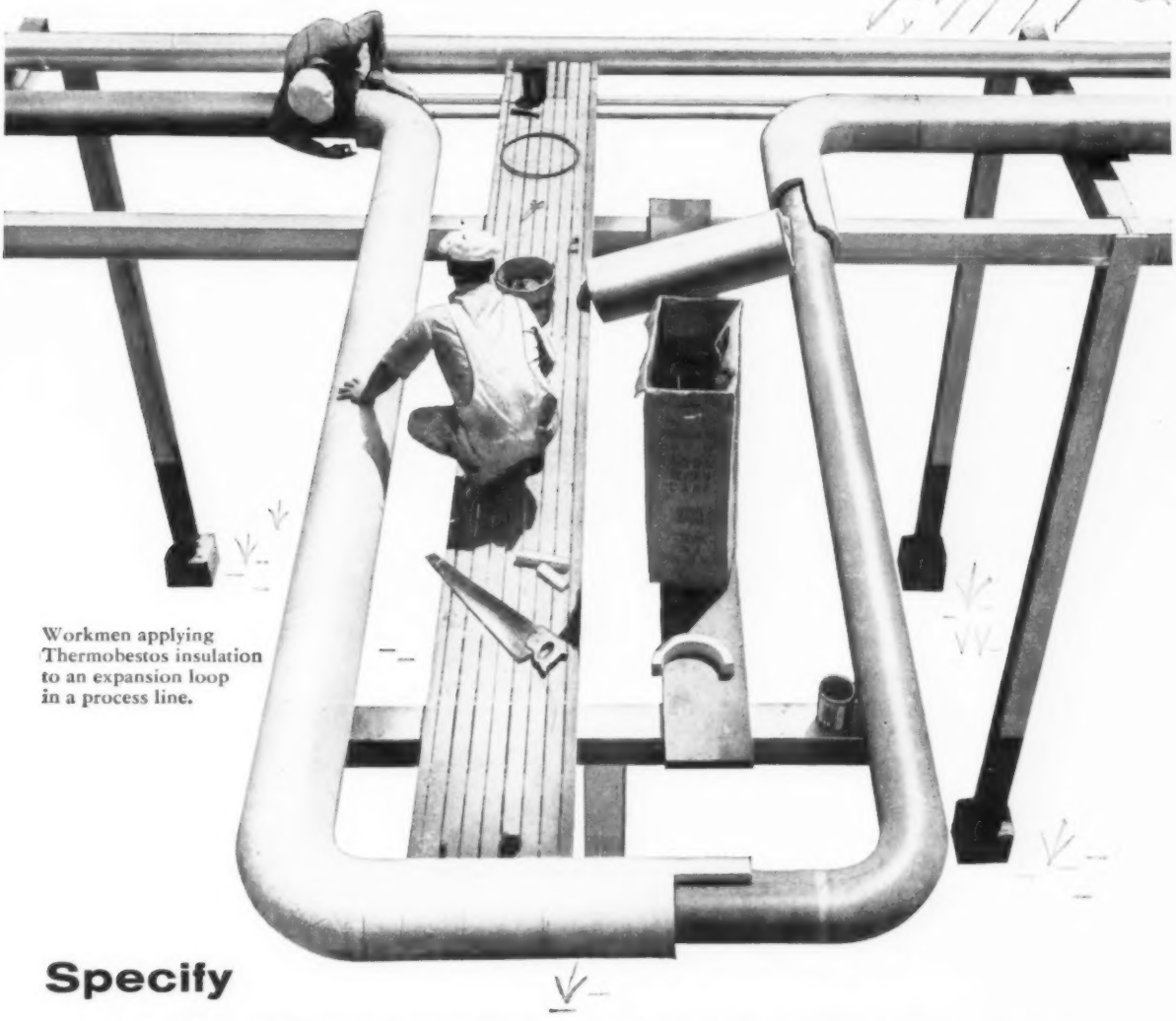
. . . for electrical controls: *Manual GEA-6372* is a 32-page illustrated publication that explains how and where to use manual starters, magnetic starters, reduced-voltage starters, push buttons, relays, limit switches, float switches and other types of general purpose electrical controls. General Electric Co., Schenectady 5, N. Y.

Circle No. **60** *on Reply Card*

Gear Pumps

. . . for pumping many types of liquids: *Northern Nitralloy Gear Pump Catalog* gives complete design, performance and engineering information regarding these block pumps. Also in-

When you're fighting the weather as well as heat loss



Workmen applying Thermobestos insulation to an expansion loop in a process line.

Specify

J-M THERMOBESTOS® the heat insulation designed for outdoor process industries

Here's proof that rugged physical strength and high insulating efficiency can be combined in one material. J-M Thermobestos is strong and rigid, yet light enough for easy handling and fast application. It is not damaged by prolonged wetting. Its hard composition resists crushing and will withstand unusual service abuse. The low conductivity compares favorably with other accepted industrial insulations.

This unique combination of properties means excellent temperature control and minimum maintenance cost for oil refineries, chemical processing plants and other plants with outdoor vessels and hot piping.

Made from calcium hydrosilicate, Thermobestos is molded to size for proper fit. Its high strength makes it particularly adaptable for time-saving shop prefabrication of fittings and bends. Furnished in large sections, Thermobestos is easy to apply. It reduces the number of joints. In pipe insulation form, it comes in a complete selection of sizes up to 24″ x 3″ half-sections. Also available in 6″ x 36″ and 12″ x 36″ blocks in a full range of thicknesses. For further information write to Johns-Manville, Box 14, New York 16, N.Y. In Canada, Port Credit, Ontario.

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(New York City residents, add 3% city sales tax)

cluded in general engineering information about viscosities, pipe velocities and pipe sizes. These pumps are available in sizes from ¼ to 146 gpm, and may be obtained in nitralloy, nickel cast iron, bronze and stainless steels. Northern Ordnance Inc., Minneapolis 21, Minn.

Circle No. **61** *on Reply Card*

Reference File

. . . of Bakelite Plastics: a revised 1957 edition of a reference book on polyethylenes, vinyls, phenolics, styrenes, epoxies and polyesters. This condensed 16-page booklet boils down into easily understood terms the major fields of applications, fabricating techniques, and outstanding advantages of each of these plastics. Bakelite Co., 30 East 24nd St., New York 17, N. Y.

Circle No. **62** *on Reply Card*

Business: Large and Small

. . . the latest in the *This Is DuPont* series: a 32-page booklet describing the roles of both large and small businesses in the American scene. Tracing the growth of the American business community, the booklet points out that both large and small businesses are needed today, and will probably be needed in tomorrow's growth. Public Relations Dept., E. I. duPont de Nemours and Co., Inc., Wilmington 98, Del.

Circle No. **63** *on Reply Card*

Plastic Equipment

. . . for resisting corrosion: *Catalog C-14* gives complete coverage of the wide range of synthetic resin formulations from which many pieces of equipment can be fabricated. Described in the catalog are pipes and fittings, valves, ducts, tanks, towers, heat exchangers, pressure equipment and agitators. Also included are data on chemical-resistant cements and the field construction of plastic equipment. Haveg Industries, Inc., 900 Greenbank Rd., Wilmington 8, Del.

Circle No. **64** *on Reply Card*

Self-Locking Set Screws

. . . use an integral nylon pellet in the threads to prevent loosening: *Form 2193* describes this unique socket screw which locks wherever the wrench stops, whether or not it is seated. These screws come in socket head, button head, flat head or socket head shoulder screw types and will withstand temperatures from -70 to 250°F. Standard Pressed Steel Co., Box 711, Jenkintown, Penn.

Circle No. **65** *on Reply Card*

A dozen vessels built by Newport News were furnished under contract with C. F. Braun, Inc., of Alhambra, Calif., design engineers for the ultra-modern Delaware Flying A Refinery of the Tidewater Oil Company located 15 miles south of Wilmington.

Newport News builds 12 major components for new Flying A 130,000-bpd refinery

This is the new Tidewater Delaware Flying A Refinery now under construction near Wilmington.

Newport News fabricated 12 of its major vessels — 2 of which are the largest such units ever built: a 250′ Orthoflow fluid "cat cracker" converter and a 225′ reactor scrubber of the fluid coker.

More notable than size, though, is the quality of the Newport News fabrication.

Coke-out screens in the reactor scrubber, for example, are made of 704 12% chromium segments. Welded together with accuracy, they provide 45% clear opening . . . with opening tolerances less than 1%.

You get expert fabrication, the skill of specialists when Newport News builds your equipment. When you want reactors, pressure vessels, vacuum tanks and the like, sub assemblies or weldments in almost any size or shape, get a bid from Newport News.

Send for newly published, easy-to-read, illustrated booklet, "Facilities and Products". It describes the many ways in which Newport News can help you with present or future projects. Write for your copy today.

Full advantage was taken of the Newport News deep water loading facilities for transportation of all of the equipment by barge. Shop erection prior to shipment assured fast, trouble-free field assembly.

Engineers: Desirable positions available at Newport News for Designers and Engineers in many categories. Address inquiries to Employment Manager.

Newport News Shipbuilding and Dry Dock Company, Newport News, Virginia

EDITORIALS . . .

Is asphalt losing by default?

FROM WHAT we have learned as a result of numerous conversations during the past few months, it looks as if the asphalt people are letting their markets be drained out from under them.

As brought out in the lead article this issue, pg. 39, the outlook for asphalt is good—but we don't think it's a sure thing, nor that it's as good as it should be.

The $50-billion highway building program now getting under way calls for 750,000 miles of new roads to be built over the next decade or so. These roads will be paved with either asphalt or cement. The extent to which each will be used depends largely on how each is promoted and sold.

The cement industry, largely through its Portland Cement Assn., is doing an excellent job of promoting its product. Its advertising program is being carried out at an increased tempo. A large amount of engineering data has been developed on the use of concrete. Plant facilities have been expanded. In every way the cement industry has moved into high gear in a determined effort to get the lion's share of the increased road building business.

This is not to say that the asphalt people have done nothing. Both the Asphalt Institute and individual refiners who make and sell asphalt have made considerable progress in telling the asphalt story. But they haven't done nearly as good a job as the cement people.

Why?

We think it's because refiners themselves, the ones who make the asphalt, haven't been too interested in making much more of it. Asphalt is a bottom-of-the-barrel product, and its price reflects its low position in the manufacturing scale. Today it sells for about the same as residual fuel oil, although it requires a lot more in the way of blending, inspection, and storage. Admittedly, a refiner is going to be more interested in making fuel oil or gasoline if he can make money that way.

So what's the solution? Simple: Figure out how to make asphalt a more attractive product, one that returns more net income to the refiner. We think there are several ways to reduce asphalt manufacturing and marketing costs, to add incentive to its promotion and sale.

The largest single users of asphalt are the road building contractors. They buy asphalt according to the specifications and inspection requirements of the various state highway departments. Therefore, we think the oil industry as a unit should be working with the individual states to achieve these goals:

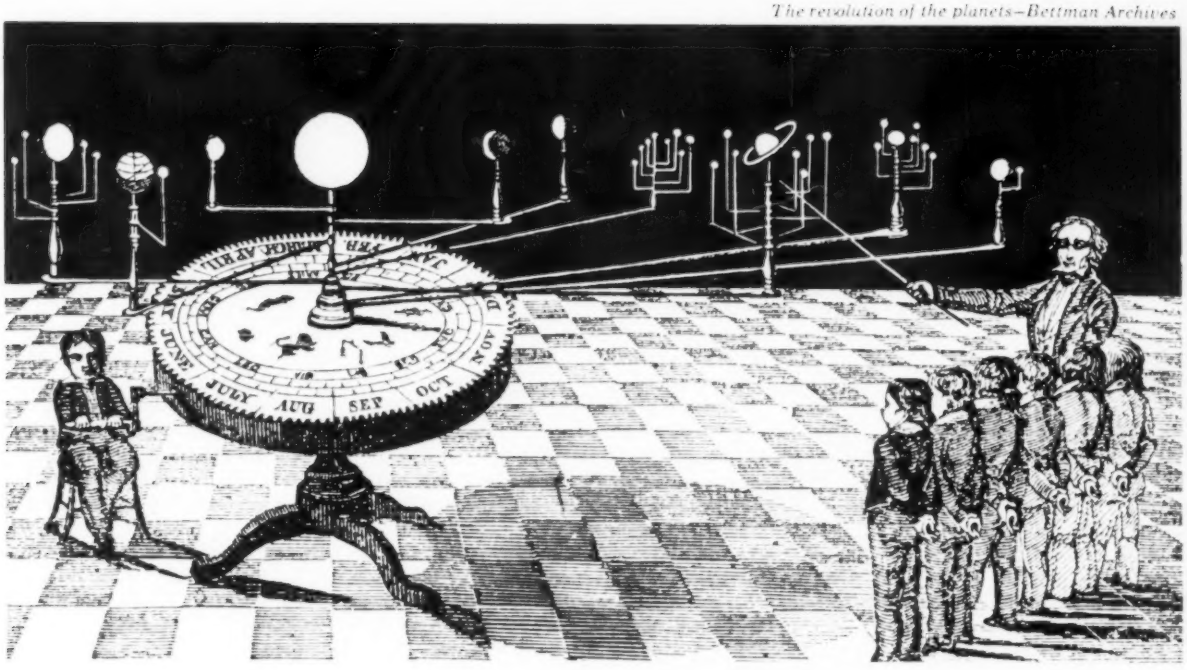
1—Recognize standard specifications. At present, the Asphalt Institute has standardized on 31 grades of asphalt—9 cements, 18 cut-backs, 4 emulsions. But some states have their own specifications—which differ for the most part only in minor details not important in the use of the material. Yet these variations require the refiner to make special batches to meet them.

2—Eliminate duplicate inspections. Asphalt inspected and approved in one state as meeting an accepted specification should be accepted in other states without further inspection. The double inspection now called for on inter-state shipments—both in the state of origin and state of use—is needless and wasteful.

3—Simplify inspection requirements. The insistence by most states that all asphalt must be inspected and approved on a batch basis prior to shipment is unnecessarily costly to refiners. It prevents them from realizing the economies of continuous stream blending with delivery directly to tank cars or trucks, and it ties up a great amount of tankage.

Only the coordinated efforts of the industry, working through the Asphalt Institute, will influence the state highway departments to bring about these changes, and make it attractive for refiners to promote asphalt. Otherwise, the industry might as well decide to pass up the asphalt business it should be—and very easily could be—getting.

The revolution of the planets—Bettman Archives



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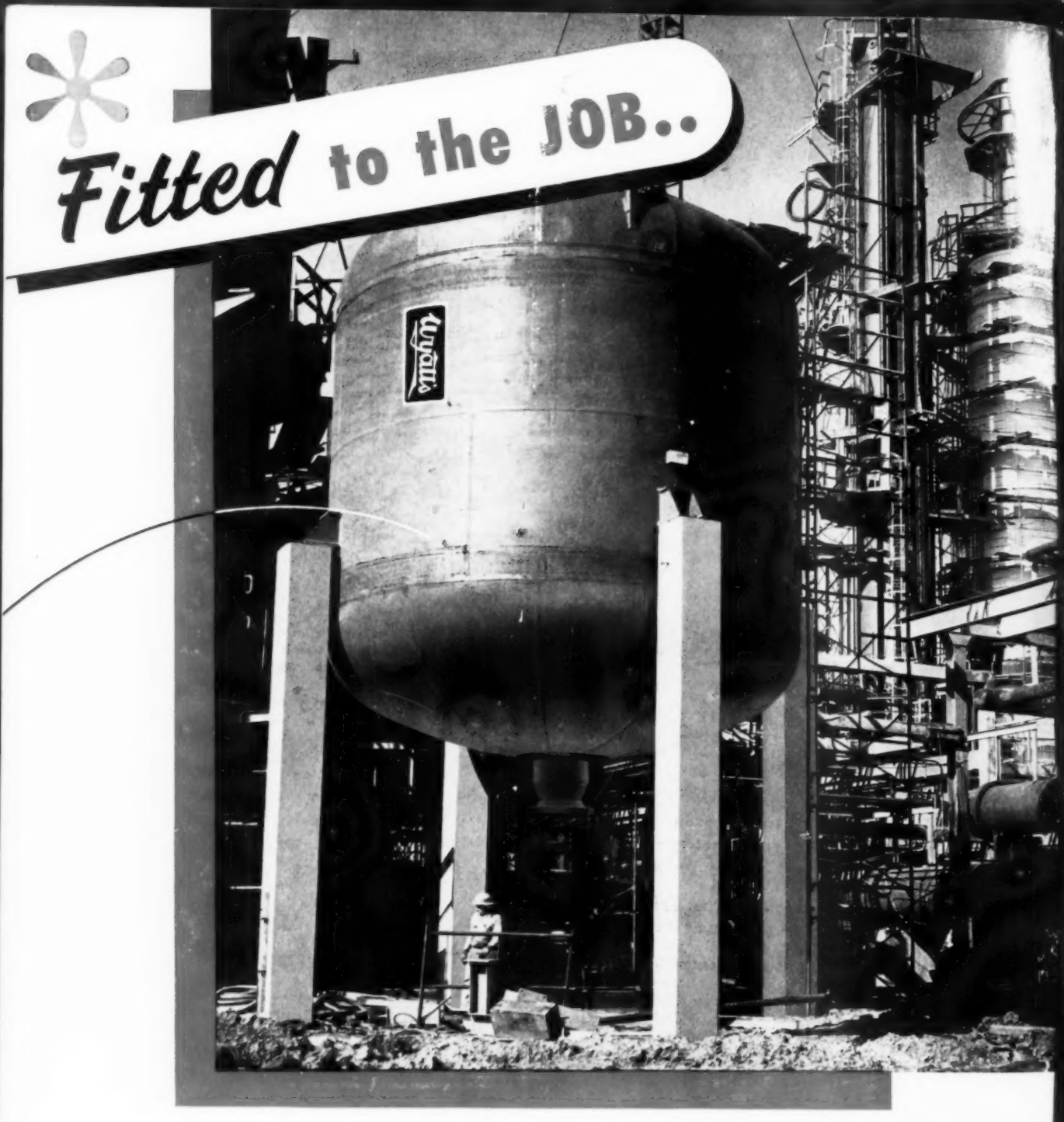

● This Reactor in the Expansion of a Gulf Coast Refining Plant operates at 530 pounds W.P., and temperature of 750°F.

Fabricated from ASTM A-204 Plate 3-11/16 inches thick: All seams 100% radiographed and completely stress relieved.

Shipped in one piece from Wyatt's Houston Plant to final destination.

- Overall Length 27 feet, 2 inches
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- Weight 215,000 pounds

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